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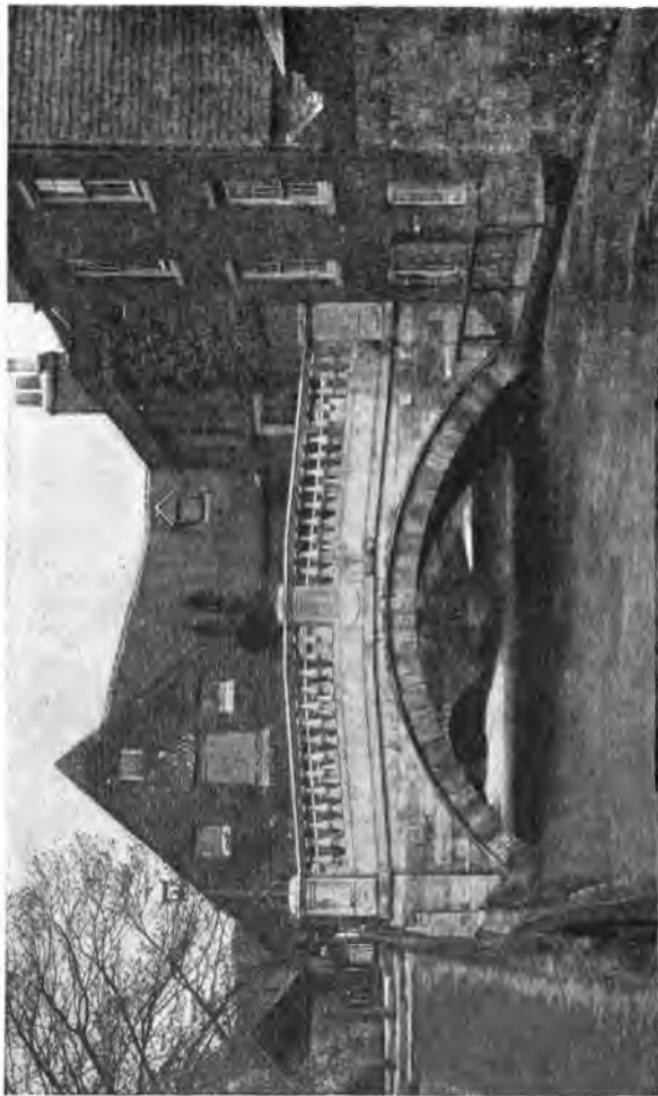
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THE OLD MILL AT WINCHESTER, ENGLAND.

THE STORY OF A GRAIN OF WHEAT

BY

WILLIAM C. EDGAR

EDITOR NORTHWESTERN MILLER



WITH FORTY ILLUSTRATIONS

NEW YORK
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THE STORY OF A GRAIN OF WHEAT

CHAPTER I

Introductory—Wheat's story—Early development—The black-bread era—The white-bread period—Further progress—The mission of wheat

THE writer does not claim to be an authority on wheat; neither by scientific knowledge nor by exhaustive study is he qualified to thus approach the subject. His point of view is that of one who, glancing rapidly over the marvellous history of this king of cereals, and noting the development of its growth and usage to conform to the requirements of modern civilization, is concerned more with the actual food problems of the present time and with questions touching the immediate future of the world's food supply than in the deeply alluring by-paths of chemical and botanical research or in the no less absorbing study of statistics, which sometimes leads even the wisest of the unwary into many strange and bottomless pitfalls. Such lines of research must be left to the specialist, and the literature concerning them is already extensive and growing greater with the increase of governmental inquiry and commercial progress.

For the purpose of this story, we may leave the scientist in his laboratory and the compiler of

statistics in the maze of figures with which he has surrounded himself, and so, touching but lightly upon the more profound phases of the subject, attempt to briefly narrate the achievements of the past in wheat culture, and reserve for more extensive consideration questions of vital interest to the bread-eaters of to-day.

The story of a grain of wheat must be at the same time the story of a sack of flour and the story of a loaf of bread, in order to be at all comprehensive, and yet we may not, for lack of space, dwell upon the technical making of flour or the baking of bread. Each of these subjects would require a book in itself, and many books there are, printed in various tongues, which treat of them. Wheat is flour, flour is bread, and bread is food, the chief of all foods; man's constant mainstay and support from time immemorial, the primary object in his struggle for existence. Food for the stomach takes precedence in the long list of man's demands upon the world, and bread has been the cry of the needy since history's beginning.

The story of a grain of wheat tells the story of man's long-continued struggle for plenty; the response of nature to her children asking for food; the emergence of mankind from savagery, when, regardless of anything save the pangs of hunger, the first miller plucked the berry from the stalk and, using his teeth for mill-stones, ground grist for a customer who would not be denied—his stomach.

Thence onward, growing more sophisticated and taught the need of forethought by dire experience, man planted and reaped his slender crop by the most primitive of implements; he ground his poor stock of wheat in a rude mortar with a

rugged pestle, putting by his stock of rudimentary flour against a time of need which was sure to come. Then came larger fields, planted in more generous measure and cultivated by clumsy yet still improving tools, with greater crops following more intelligent handling. Poor fields at best, telling a pathetic story, as we look back upon them from the civilization of to-day, yet dear to the pioneer farmer. Tilled sometimes by slaves driven to labour with blows; sweating and groaning at unending tasks. More happily, sometimes, by honest yeomen who first wrested their ground from nature and then defended their crops from the prowling beasts, from marauding bands of soldiers, from the thief by night and the oppressor by day. Gaining at last a comparatively poor crop, from which, after paying tithes and taxes in ample measure, something—barely enough to keep body and soul together—was finally garnered and safely housed for the season's use. Then, to the miller of the day, with his creaking wind-mill grinding out the grist on ill-dressed stones, with clumsy machinery, curiously inadequate; he, also, taking his share of the harvest for his labour. Thus came the era of black bread, coarse and dirty, fit only for strong teeth and the digestive apparatus of a rugged outdoor man.

The black-bread times, when the flour of all save the very rich was dark and filled with the impurities incident to the primitive method of its milling. The black-bread times, when the peasant was overridden and crushed to earth by his domineering and arrogant rulers, merciless in their treatment of the toiler. Those old wheat-fields eloquent of man's inhumanity to man; often beat-

en to the ground by the tramp of armed hosts just as the beautiful berry was reaching its maturity. The peasant farmer and his wife and children emerging from concealment to witness the ruin of their season's hopes, thankful to encounter starvation even, if they are left but a roof to cover them. Then the years of failure and blight, when both nature and man conspired against the wheat; when drought and taxes scraped the fields bare, and the man who planted them, huddled hungry in his hut, thinking the murder and arson which later was acted to the ominous music of the *fa ira*. So, by natural ways, sowing the wind, reaping the whirlwind, to the oft-repeated and terrible cry of "Bread or blood!" mankind told the story of wheat in sanguinary and imperishable characters which future generations dare not disregard; contemporaneously writing the story of human liberty; the striving to hold and enjoy that which the labour of man's hands had brought from the soil.

Then, in this story of wheat, come brighter chapters with the dawn of a higher and better civilization, and the coming of less frequently interrupted peace. The beautiful wheat-fields of modern Britain extending all about comfortable homes, neat cottages, and noble mansions; a land protected by just laws and governed wisely; her people safely guarded against oppression from within and invasion from without. Rich fields tilled industriously and yielding abundantly; the work-ground of a happy people, who laboured to good effect. The grain taken to mills of some magnitude, cleaned and scoured on somewhat scientific principles; ground into flour on mill-stones; giving a beautiful golden product from

which was made a bread as far superior to the black bread of the Continent, as was England's liberty to continental freedom. The miller, typified by him of the Dee, a man of influence and weight in his community, serene and prosperous. And all, from the farmer who planted to the miller who ground and the baker who baked, somewhat uplifted by having to do with King Wheat under favouring circumstances.

Still pleasanter and more inspiring are the later and grander chapters in the wonderful tale of a grain of wheat, and what it has done for man. The story crosses a wide ocean and is taken up by that consistent wheat-grower, the Anglo-Saxon, in a newer and wider and even freer land. The chapter on America, still open and continuing, tells of the march of the pioneer from east to west, always accompanied by a larger expanse of wheat-fields; of records made in wheat production only to be broken by other and still greater ones; of a new nation reaching out to feed an older world; of vast systems of railway and steamship transportation created in response to an increasing demand for bread abroad and a steadily growing production of wheat at home; of crops unparalleled in the world's history for magnitude and quality; of enormous fields cultivated by machinery of marvellous ingenuity; of gigantic mills, elaborated and scientific of process, grinding day and night with rank upon rank of steel rolls, a product of surpassing colour and quality, purified of all deleterious or unclean substances, being the purest and most nourishing food ever provided for the human race, making an ideal bread, healthful, clean, and strength-producing, the food of the twentieth century, the climax of the white-bread era.

Moving still onward and never resting even as man's ambitions never sleep, the story of wheat goes forward. Yesterday a wilderness, to-day the abode of the pioneer, to-morrow a waving field of grain. Northward over the boundary of the United States into the Canadian northwest, spreading over lands but recently supposed to be valueless, marches on the King of Cereals, bringing civilization and law and order and justice with him. A thousand, fifteen hundred, two thousand miles to the north and west and still are found wheat-fields yielding phenomenal crops of superb quality. This is the latest achievement in the white-bread era, and men are wondering how many more thousands of acres are available for the culture of this plant before the word *finis* is written.

The climax of development thus far in the white-bread era is found in the spectacle afforded by one of the great flour manufacturing plants of the time, employing hundreds of skilled millers, driven by powerful engines with steam or water power or both, equipped with every mechanical device which can contribute to the quality of the product or the cheapness of operation, humming, throbbing, and thrilling with industrial life, operating steadily the year around and producing from five to ten thousand barrels of flour daily. Contrast this with the poor, fitful wind-mill of the black-bread age with its meagre equipment of primitive machinery and its miller or two, and some idea is gained of man's progress in the matter of flour-making.

Perhaps a more striking contrast even than this is the picture of a modern field of wheat just ready for harvest. Five thousand acres given over



A Field of Wheat.

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exclusively to wheat-raising. Stretching in every direction as far as the eye can see, one unbroken, waving mass of grain. The sight is glorious and inspiring, and when the mind recalls the little patch of doubtful grain, brought from the soil by arduous, unintermittent, unintelligent labour; dwarfed, insignificant, harried and threatened, and yet pathetically precious to the peasant wheat-grower of the black-bread period, the soul is lifted up, and the glorious story of a grain of wheat is told without words in a picture painted by the hand of a gracious Almighty, who, through the ages of oppression and fear, has brought forth his people to be witnesses of his greatness through the hand of man and the bounty of nature.

Thus the tale of wheat is ever the story of man's achievement with God's help, each chapter marking an upward step in human progress, an advance in knowledge, science, and civilization; finally triumphing in a brotherhood of man wherein the east may be hungry but the west will not let her starve. Interdependent, the nations shall feed each other, and wheat will continue its beautiful mission of peace and good-will; and there will be no more hunger in all the world.

CHAPTER II

The wheat berry—Chemically and botanically considered —Its enemies, diseases, and pests

BOTANICALLY, wheat belongs to the grass family and is in fact a modified form of grass. Its pedigree shows it to have some rather disrepu-

table near relatives; certain weeds of doubtful reputation and some worthless plants, such as wild rye and wild barley; indeed quack-grass is only five places removed from the worthy hero of this story. On the other hand, wheat is closely related to a number of valuable forage crops, such as its English cousin, rye-grass.

There are four main divisions in the family of wheat: common wheat, dwarf and hedgehog wheat, English and Egyptian wheat, and flint wheat, to which the durum varieties belong. Each of these divisions, or sub-races, is again divided into a number of varieties which have been produced, probably, by crossing the sub-races. There is only one form of wheat known in a wild condition; this is quite different from ordinary wheat and is called one-grain wheat.

The family of wheat is not only very noble, but it is also a very ancient one indeed. It is difficult to estimate with any degree of accuracy the length of time it has been used as food by man. Archæologists contend that it was thus utilized in prehistoric days. The stone age probably knew it. It has been found in the ruins of the ancient lake-dwellers of west Switzerland, and discovered in the remains of Egyptian civilization. The learned Chinese, who seem to have a more or less valid claim for the original patent on almost everything in modern use, modestly state that wheat was grown in China some 2,700 years before the beginning of the Christian era. Undoubtedly, wheat has undergone many changes in form, properties, and characteristics during the time it has been cultivated by man, but the fact that it claims a record of more than 4,600 years of faithful service to mankind is the best evidence of its ster-

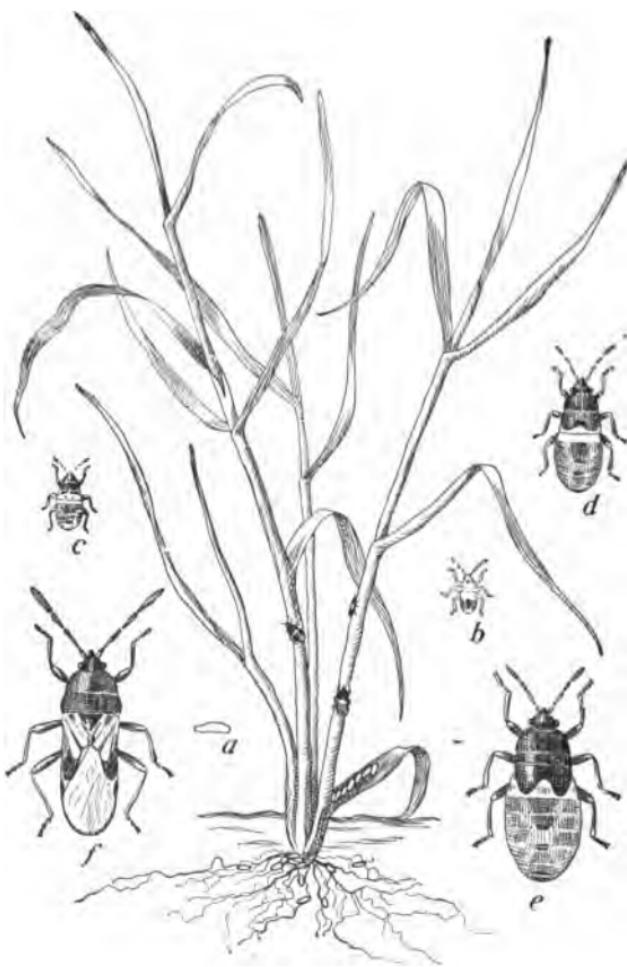
ling character and value as food. It is only during recent years and in America that the claims of certain base pretenders to the honoured place occupied for the ages by the wheat family have been put forward, and as these claims are advanced by alleged "health-food" manufacturers for purposes of personal gain, and are not indorsed by reputable scientists, it is quite safe to class them with the innumerable past attempts of faddists and quacks to overcome long-established usage, and to predict that as long as the human race inhabits the earth, wheat will hold first place in the list of valuable foods.

Wheats from different sources vary in many respects; white, red, and amber in colour; wheats with large and wheats with small kernels, and wheat weighing from 55 to 65 pounds for a measured bushel. When converted into flour and made into bread even greater differences appear. Certain wheats make larger and whiter loaves than others, and there are differences of colour and taste which are noticeable. When the causes of all these variations are examined into it is found that while all wheats have the same general chemical composition, they vary to some extent in the amounts of different ingredients which they contain. Even in a single variety, some of the kernels are larger than others and more mature, some may be shrunken, wrinkled, bleached, frosted, or perhaps germinated or "bin-burned." It may be afflicted with fungus diseases or show the ravages of insects. In fact, during its growth, wheat is subject to many ailments and adverse climatic conditions which have an unfavourable effect upon the bread made from it.

To a considerable extent, science has come to

the assistance of the wheat-grower and has shown how some of the difficulties in the way of perfect wheat can be overcome, and how the spread of fungus diseases and insect pests can be checked. For example, smut is a fungus disease transmitted from the parent seed to its offspring. When smutty wheat is sown as seed the crop becomes infested with the disease. If, before sowing, the wheat is treated with certain chemicals, wheat medicine so to speak, the smut spores are destroyed and the spread of the disease is prevented. Again, the black rust of wheat is a parasitic disease in which the leaves become gradually covered with brownish black spots which spread from small infested centres. Under favourable climatic conditions, this epidemic may spread and involve the entire plant and even cause a loss of the crop. A study of this disease has shown that, in one of the stages of its development, the parasitic growth lives for a time upon another and entirely different plant, the barberry, and if this barberry be not at hand, the cycle of growth cannot be completed. Outbreaks of black or summer rust have been directly traced to the barberry, and it is well established that this fungus growth lives part of its life on this plant just as the trichina and tape-worm spend part of their existence in the body of some animal such as the pig. Having discovered the cause of this destructive enemy to the wheat family, science finds a cure in removing barberries from wheat-growing sections.

The family of wheat is not only subject to disease and sickness, but it has an army of enemies ready at all times to seize upon a favourable opportunity to attack and if possible overcome



THE ENEMIES OF WHEAT.

Chinch-bugs in different stages of growth. A single egg is shown in *a*, and others on the roots and a lower leaf; in *b* is shown a very young bug, and in *c*, *d*, and *e* the later stages, while *f* shows the adult and mature insect. The natural size of the bugs is shown on the stems of the plant.

it. Grasshoppers, chinch-bugs, army-worms, and frit and Hessian flies are its most destructive ravagers. Here again science has interposed to good effect between wheat and its insect enemies. The deadly grasshopper is kept within bounds, and outbreaks of this kind are far less numerous and ruinous than in former years. Large areas of wheat are saved by means of a machine termed in America the "hopperdozer." This rakes over the ground, collects the grasshoppers and introduces them to kerosene oil which destroys them. When the eggs of the grasshopper have been laid, the land is ploughed and the egg-case is inverted, consequently the infant insect is not able to make its way into the world. The ploughing of land infested with grasshoppers has proved to be the most effectual way of fighting this enemy.

Scientists have experimented with the introduction of fungus diseases among grasshoppers. Insects, like animals of higher order, are subject to disease. Some of these sicknesses are parasitic in form, and if the germ of the disease can be introduced and spread about in the fields, the healthy grasshoppers soon become diseased and die. The ravages of the chinch-bug have, under favourable circumstances, been held in check by this method of treatment. The spores or seeds of a fungus disease which attacks the chinch-bug can be grown upon other materials, such as beef broth or corn-meal, and a stock of these diseased germs can be kept on hand. In case of an attack of the insects, the ground being moist and conditions favourable, these germs can be introduced into the soil, and are capable of spreading and causing disease among the healthy, active chinch-bugs. This method of spreading disease among insects



THE ENEMIES OF WHEAT.

Grasshoppers, three-fourths natural size. *a*, Single egg; *c*, egg masses, closed and opened; *g*, male; *h*, female. Lesser migratory locust: *b*, pupa; *e*, male, *d*, female.

has been effectual at times, but, as in the case of all contagious diseases, the spread is dependent upon favourable conditions. Ravages of other insects such as the frit-fly are combated by burning the stubble ; this destroys the eggs of the insect. In the prevention of fungus diseases and insect attacks, the same principles are employed as in the prevention and treatment of human diseases. The cause of disease is first ascertained, and its prevention or treatment is dependent upon some characteristic weakness of the parasitic body.

It will be observed that the wheat family, as behooves so ancient and conservative a house, repels the attacks of sickness by active and positive old-school medicines, and that the principles of Christian Science have not been applied to any extent in the elimination of wheat diseases. It is a fact, however, that during an outbreak of grasshoppers in Minnesota in 1877, the Governor of the State appointed April 26 as a day of fasting and prayer and urged the people "in the shadow of the locust plague, whose impending renewal threatens desolation of the land," to "humbly invoke for the efforts we make in our defence the guidance of that hand which alone is adequate to stay 'the pestilence that walketh in darkness and the destruction that wasteth at noonday.'" The Governor's proclamation caused much comment and some adverse criticism. Clergymen read it from their pulpits, and in solemn tones exhorted the people to assemble together for prayer on the day appointed. The 26th of April arrived, shops and other places of business were closed, the church-bells announced the hour of service and, deeply impressed by the unusual character of the

occasion, to which the extraordinary quiet of the day contributed, the people, Protestant and Catholic alike, walked soberly to church and there prayed fervently to the Almighty for help and succour against the threatened devastation of their wheat crop, which, at that time, was of vital importance to the welfare of the struggling farmers, who had suffered severely from grasshoppers the previous year.

A strange thing followed, strange but true, as thousands of living witnesses can prove. April 27, the day following the day of prayer, the sun shone over the entire State bright and clear and with extraordinary heat. The warmth was like midsummer. It penetrated the moist earth and there found the larvæ of millions upon millions of grasshoppers. Stimulated and quickened by the heat, the infant enemies of wheat came to the earth and crawled about the surface in countless myriads, enough to destroy not only the crop of Minnesota, but that of the entire northwest. The visitation of the year previous was nothing compared with the vast army of crawling locusts which now came forth from the earth. For a few days the unseasonable weather continued, then suddenly it grew colder and one night there was a severe frost, the earth was frozen and with it the hatched and unhatched grasshoppers. In a few days it thawed again, but the pests had gone, and the wheat crop was saved from its enemies. It is true that since 1877 there have been no grasshoppers worth worrying about in Minnesota.

Not only is the wheat family assailed by disease and hostile armies, but, should it escape these, it still has to struggle for existence because moisture and proper food materials in the soil are

often lacking. The growth of the wheat-plant from seed to maturity is one constant series of chemical changes. The various food elements in the form of mineral matter, such as potash, phosphate, lime and magnesia salts, together with the water and nitrogenous compounds, are taken from the soil, while the carbon is obtained entirely from the air. The leaf is the manufacturing plant or chemical laboratory where all of the various changes take place, and where the different compounds, including starch, gluten, and oil, are elaborated. The materials that are produced in the leaf are finally stored in the seed as nourishment for the future wheat-plant. Climatic conditions, the nature of the soil, and the character of the seed are the main factors which determine the properties and individuality of the wheat.

Wheat grown on fertile soils, in northern latitudes with a short but forcing season of growth, develops more glutinous matter and less starch than wheat grown on poorer soils and in latitudes where the period of growth is prolonged. The same general laws which influence the growth and development of animal bodies are also noticeable in the growth of wheat. For example, in all young and growing animals there is first developed a framework of bone and muscle



Model of Wheat Blossom.

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if proper food is supplied. After the framework is developed the addition of more food causes the animal to undergo the fattening process. The animal will prematurely fatten if not properly fed. So with the wheat plant, the earlier stages of growth are devoted largely to the building up of the nitrogenous or glutinous compounds corresponding to the framework of the animal; while the later stages of growth are given over principally to the formation of the starch, which corresponds to the fattening period of the animal. If the normal development of the wheat is in any way checked, the kernels may appear prematurely fattened and lack strength, or slightly shrunken and shriveled, because the fattening of the kernels has not taken place.

The chemical changes which take place in the leaves of the growing plant are the results of life processes, and, like all similar changes, are not well understood. As soon as the seed passes its germinating stage, which it does rapidly when grown under normal conditions, the roots and leaves are produced and then the food from both soil and air is absorbed and elaborated into plant tissue. By the time the leaves are five inches high the first roots are about twenty inches in length, and develop rapidly in all directions. Some appear to be especially designed to give mechanical strength and support to the plant, while each individual rootlet is covered with a large number of root hairs which come in contact with the soil and absorb food. These root hairs are thick or thin in places according to the amount of plant food in the different layers of soil. The spike, which later bears the grain, is discernible even in the early stages of growth, and develops within

the hollow cylindrical stem which is connected by joints and internodes. If conditions are favourable, the grain "stools," and a number of stems or branches are developed. As the plant grows and larger leaves are produced, the earlier leaves become less active and give up their substance to the plant, the heads are unwrapped from their leafy covering and the grain passes through the various ripening stages to maturity. The blossoming stage is one of the most interesting periods in the development of the plant. The floret is complete in itself, having all the parts and organs of an ordinary flower, including ovule, stamens, pistils, filaments, anthers, and pollen.

Wheat is self-fertilizing, and at flowering time the anthers are pushed upward; they break open and the pollen grains fall on the stigma. Nevertheless some scattering of the pollen occurs during fertilization, and a sufficient opening of the flowers takes place to allow occasional cross-fertilization. By means of removing the pollen from one variety of wheat to the ovules of another, cross-breeding is accomplished, which has resulted in the production of a number of new and promising varieties.

A mature wheat kernel is a single seed enclosed in tightly fitting walls. During growth the lateral portions of the seed fold inward and the seed elongates, forming a fold or groove upon its upper surface. The covering known as the bran scale consists of three parts: the outer skin or coarsest part of the bran, an inner double skin, and a thin, hard, transparent layer. Inside of the bran, another layer of cells, called the aleurone cells, is found. The flour cells, found within the bran, and the aleurone layers constitute nearly eighty-four

per cent of the wheat kernel, of which about seventy-five per cent is recovered as flour, which is composed of starch, gluten, and other nutriments. The germ, or embryo plant, is found at the lower

end of the kernel, and is surrounded by reserved food materials. When the wheat is made into flour a mechanical separation of the different parts takes place, the germ and bran layers are removed, and the flour cells are granulated.

It is estimated that, under ordinary conditions, it will require about two square feet of land to produce enough wheat for one loaf of bread weighing a pound. Since the amount of wheat used in the aggregate is large, and is increasing faster than the population,

Model of Wheat Kernel.
lution, a few political economists have feared that in a half century or so there will be a wheat famine from exhaustion of the soil and other causes. A careful examination of the facts do not warrant such a conclusion. There is no more danger of a wheat famine than there is of a grass famine, to which family wheat belongs. Extensive wheat-fields in the Canadian northwest are now coming into cultivation and producing wheat in quantity and quality far beyond the most sanguine anticipations, from a source which only a few years ago was considered unproductive. Large tracts of land in the United States suitable for wheat-growing are still uncultivated. In ad-



dition to these resources, and the possibilities of Argentina and other wheat-producing countries, there is an enormous area in America formerly wheat-producing and now utilized for other and more profitable crops, which merely awaits the stimulus of a greater demand and consequent higher price to revert to wheat production. While such conditions exist it is impossible to estimate how long it will be before the limit of the world's wheat production is reached. There is every reason to believe that in the future the supply of wheat will increase, and that it will be more extensively used in the dietary than it has been during the past forty-six hundred years of its history.

CHAPTER III

Early history of wheat—The problem of its birthplace—Region of the Euphrates and its claims—Egyptian wheat—A discredited legend—An American wheat sensation—Biblical references

IN the preceding chapter it has been said that the origin of wheat finds no exact date in history; that the Chinese knew it and used it for food twenty-seven hundred years before the Christian era, and that it is reasonably certain that for more than forty-six hundred years it has been a human food. Grant Allen, the naturalist and novelist, has termed wheat "a degraded lily," using the adjective in its scientific sense, but how and through what transformations this cereal passed from the decorative stage of the lily to its present condition has not been vouchsafed to us.

Can wheat grow wild? This question was asked by the Chaldean priest Berosus more than twenty-five centuries ago, and has often been debated by modern scientists. Botanists have vexed their souls over it for years. There is slight if any reason for believing that wheat, as we understand the word, can grow and continue to grow unaided by man. Berosus is quoted as saying that, in his time, wheat grew wild in the valleys between the rivers Euphrates and Tigris. In recent times, M. Frederic Houssay claimed to have discovered wild wheat in a mountainous district to the east of Kurdistan, but much doubt has been thrown on this statement. Early in the nineteenth century, another French traveller, Olivier, brought home a circumstantial account of wheat, spelt, and barley growing together and apparently wild in a district northwest of Anah, on the right bank of the Euphrates. These cereals were discovered by him in a wild and desolate country, where one would not have expected to find cultivation of any kind. With regard to this testimony, which supporters of the theory of the wild origin of wheat have often and triumphantly cited, it may be remarked that Olivier, beyond the fact that he had observed the three cereals in question growing in a wild and out-of-the-way spot, does not bring the slightest evidence to show that the plants were growing wild. That part of the world was then, as it is to-day, thinly inhabited, but it was constantly traversed by nomadic tribes, which, though still in the pastoral stage, and without fixed habitations, were quite capable of sowing on their outward way that they might reap on their return. The mere fact that wheat and barley were growing side by side in an

uninhabited spot by no means proves that those cereals had not been planted by men for their use.

Among old authors who have helped to encourage the wild-wheat legend is Strabo, who was born just before the Christian era. He quotes Aristobulus as saying that on the banks of the Indus there grew wild a plant much like wheat. The same authority maintains that in his day grains shed from wheat spikes in Hircania would take root and grow wild; but of course the point to know is, did those plants degenerate and disappear, or continue from generation to generations? On this all-important matter Strabo is significantly silent. Botanists are generally agreed that, though wheat and other cereals, such as barley, oats, and rye, may have been found growing apparently wild in lands where cultivation is already known, such plants are only to be considered as relapses. In other words, cereals growing under such conditions are no more to be classed as wild than men who have broken away from the restraints of civilized life and voluntarily returned to savagery can be classed as wild men in the true sense of the word. It is somewhat remarkable that no instances of wheat or of any other cereal growing wild have ever been reported from really primitive lands: from countries having virgin forests and occupied only by races not yet risen from the hunting stage. Universal experience has shown that to thrive cereals need the constant care of man.

Before leaving this subject, it may be pointed out that more than one respectable authority has been misled by the superficial resemblance to wheat of certain grasses which are nothing better

than weeds. A classical instance of this is found in the grave assertion of Diodorus Siculus, who lived at the commencement of the Christian era, to the effect that wheat was growing wild in his native land of Sicily. To-day there are no traces there of what can be properly termed wild wheat, but many districts in which cultivation is light are overrun with a grass known as *Aegilops ovata*, in which some botanists have seen a distant but poor relation of wheat. The natives of Sicily to-day call this weed in their dialect *frumentu sarraggiu*, or wild wheat. This *Aegilops ovata* is not infrequently to be found growing beside wheat, especially in the south of Europe, where cultivation is apt to be slipshod. That some varieties of the *Aegilops* germs are akin to cultivated wheats in the same sense that prairie wolves are related to terriers is freely admitted by botanists, including Hooker and Haeckel; cultivated wheats of all varieties will intercross with many kinds of *Aegilops*, but the result is no more to be desired than the offspring of a wild wolf and a well-bred hound. The gulf to-day between wheat and the wild grasses of the *Aegilops* genus is too wide to be bridged, although the theory that in prehistoric ages all these diverse forms of grass came from one common ancestor is of course quite tenable.

The cultivation of wheat is apparently coeval with the birth of civilization, using that term in the sense of the transition of primitive people from the nomadic to the settled life. It is remarkable that the origin of wheat is, in widely separated lands, the subject of identical mythical legends. The ancient Egyptians spoke of Osiris, the Nile god, as having taught the dwellers in the

Nile valley the use of the plough. Greek and Roman mythology is full of tales of gods and demi-gods descending to earth to teach men the use of cereals and the construction of permanent dwellings. The Chinese, that people of ancient civilization, hold that wheat was a direct gift of heaven, and, as already stated, there is evidence to show that they cultivated this cereal twenty-seven hundred years before the Christian era. One of the most striking ceremonies of the Chinese court is the solemn ploughing of a field by the emperor in person; this curious ceremonial was originally instituted by the Emperor Chin-nong or Shen-nung, as some scholars write his name, who drove the plough himself, as his successors do to this day, to pay practical homage to the dignity and value of agriculture. On this occasion the work of the plough is followed by the sowing of five kinds of seed, namely, wheat, rice, soy, sorghum, and *setaria italica*.

The antiquity of wheat culture in Europe is beyond question. There is reason to believe that the lake-dwellers of Switzerland were growing a kind of wheat at least as far back as the Homeric period; remains of the grain they raised have been found and described by Mr. Heer, who gave it the name of *Triticum vulgare antiquorum*. The grains of this wheat were very small, and though presenting great affinity to, are by no means identical with, any variety grown to-day. In Lombardy the archæologists Regazzoni and Sordelli found a similar kind of grain buried among prehistoric remains. At Aggtelek in Hungary discoveries have been made of a prehistoric wheat, which is also of this variety, and is believed by antiquarians to have been grown in the stone age.

The problem of the original home of wheat is obscure and probably unsolvable. Mesopotamia has been claimed as its native land, but the evidence in its favour does not appear strong enough for unhesitating acceptance. Herodotus, the gossipping Greek historian, speaks of the marvellous fertility of this region, which yielded a hundred-fold to the sower of grain. This writer is an untrustworthy guide at the best of times, but his story is an evidence of the good reputation of the Euphrates and Tigris valleys as wheat-fields in his day.

M. De Candolle, in his *Origin of Cultivated Plants*, abandons the task of fixing upon the birth-place of the King of Cereals. Philology, as he admits, affords but a slender clew in this case. The Chinese *mai*, the Sanskrit *sumana* and *godhuma*, the Hebrew *chittah*, Egyptian *br*, and other names, are all synonymous of wheat in the most ancient languages, but it may fairly be inferred that the cultivation of wheat, although primitive, antedates the most ancient tongues known to modern civilization. Altogether, since Mesopotamia seems to have the best claim to the distinction, it would seem permissible to consider the first wheat-fields known to history to have been situated there.

To the student of the archæology of wheat, Egypt, that land of prehistoric civilization, presents a field of absorbing interest. That grain was grown and consumed by the ancient Egyptians is beyond question, but Egyptologists are divided as to the age of wheat culture in that country. Before setting forth the views of the few scholars who have made a special study of ancient Egyptian agriculture, it may be remarked that each and all of these authorities are anterior

to the modern age of Egyptology, which barely dates back a quarter of a century. The discoveries of Maspero and his school have greatly extended Egyptian history, and have taken the story



Wheat Market, Assouan, Egypt.

of its civilization back to a very remote period. The origin of wheat culture in Egypt must remain, it is to be feared, as obscure a problem as that of the original home of this cereal. Some authorities doubt the use of wheat or of any grain by the aboriginal inhabitants of the Nile valley. The primitive men who lived by the banks of the Nile before the formation of the delta are supposed to have lived on fish and plants of the lotus variety. But the formation of the delta is dated back by geologists quite twenty thousand years,

and an antiquity of half that period for wheat and barley would be a respectable pedigree. Dr. Budge, the head of the Egyptian department at the British Museum, is not inclined to believe that wheat is indigenous in Egypt or that it was grown there in very ancient times. He does believe, however, that in prehistoric days a red grain was cultivated, which he is inclined to identify with barley, though this seems questionable. The white wheat which was grown in the later days of Egyptian civilization is, in his opinion, clearly an exotic. He thinks it may have come from Asia.

In dealing with Egyptian archæology it behooves a searcher to step warily, because recent discoveries have revolutionized Egyptian chronology, and it must be admitted that even to-day specialists in Egyptian lore are by no means unanimous on the crucial points of chronology as determined by the monuments of ancient Egypt.

Franz Unger, an Austrian botanist and scientist, who spent some time in Egypt and produced several monographs on the prehistoric and ancient flora of the land, has taken the history of wheat and other cereals in Egypt back to a very remote date. Unger remarks that in tombs of great antiquity he has discovered seventeen distinct varieties of plants, all so well preserved that in each case the exact species could be determined. His researches led him to the conclusion that wheat, though not indigenous in Egypt, was grown there in prehistoric times. In some bricks from the walls of Eilethyia he found straw which he was inclined to identify as wheat straw, though on this point some doubt exists. Later he discovered a grain of wheat in a brick from the pyramid of Dashur; the date of this monument he placed at

thirty-three hundred b. c. Remarkably enough this grain bore a strong resemblance to the small-grained wheat discovered in the piles of the lake huts of the aboriginal Swiss, to which reference has already been made. The importance of this discovery, always assuming the correctness of the age attributed to this monument, need not be emphasized. In Unger's opinion, the ancient Egyptians cultivated many kinds of wheat besides the variety discovered. A bearded spring wheat and a winter wheat without beard are described by Theophrastus, and in ancient tombs several specimens, more or less well preserved, have been found. Unger says that the wheat commonly grown in Egypt was that known to botanists as *triticum turgidum*, and that this variety was also known to the ancient Egyptians, being figured on their monuments and found in graves of great antiquity. But antiquity is a term of relative meaning, and an ancient monument in Egypt may carry us back three thousand years or it may carry us back ten thousand years.

In the comparatively modern days of Herodotus the Egyptians were evidently great bread-eaters, as he twice refers to this food. In one passage he says: "Other nations feed on wheat and barley, but the Egyptians hold this food in the greatest contempt and feed on spelt which some call *zea*. Dough they knead with their feet, but clay with their hands." Elsewhere he says: "The Egyptians eat bread which they make from spelt and call *kullestis*." This is a typical instance of the inaccuracy of Herodotus. There is no reason to believe that the Egyptians despised either wheat or barley. On the contrary, both these grains as well as sorghum (*durra*) are pictured in votive

offerings to the gods. Moreover, although the Greek word *olura* is usually taken to mean spelt, it is probable that Herodotus mistook for spelt *triticum monococcum*, which is no longer grown in Egypt. The loaves he speaks of were baked with leaven and were usually circular and flat in shape like crumpets or muffins. In some cases Egyptian bread was shaped like modern rolls and sprinkled on the top with seeds very much after the style of some Vienna rolls of to-day. Sir Gardner Wilkinson, in his *Manners and Customs of Ancient Egyptians*, tells us that in ancient Egypt the rich lived on white bread, while the poor were content with loaves of barley and durra. The same is probably true to-day, especially in regard to durra. Barley was extensively grown in ancient Egypt and its culture may have preceded that of wheat. Besides serving the poorer classes for bread, barley was used in ancient (as in modern) Egypt for making a kind of beer locally known as *Bozoa*, which word is said to have been brought by gipsies to Shakespeare's England, and to have been corrupted into the vulgar English "booze." The brewing of this beer was practised in Egypt as far back as the time of Herodotus.

Sir Gardner Wilkinson has given some interesting notes on the agriculture of ancient Egypt, which does not seem to have materially differed from that practised at the present time. The plough of the fellah to-day is much the same as that used by his predecessor three thousand or four thousand years before. Sir Gardner says that the system of thrashing used in ancient Egypt was practically identical with that of the present day. In these days when wheat or barley or

durra have been gathered, the grain is bound up into sheaves and carried to a level and cleanly swept area near the field; after the grain has been spread about the ground it is thrashed by a machine known as the *norag* which is drawn by two oxen. This norag consists of a wooden frame with three cross bars or axles in which are fixed circular iron plates to bruise the ears of corn and extract the grain, while the straw is cut up into small pieces. A similar method was followed by the ancient Egyptians, the only difference being this, that while in modern Egypt the oxen go around the heap of grain which is in the centre, in old days they traversed the wheat spread in a kind of circle around the floor. Reaping was evidently a favourite subject of ancient Egyptian artists, and several representations of the cutting of both wheat and barley are given by Unger; one figure representing the cutting of barley is reproduced from a very ancient tomb at Gizeh. The reapers are using sickles shaped much like those of the present day, and it may be noted that they cut the grain at various points: close to the head, in the centre, and more rarely near the ground.

It has frequently been asserted that wheat found in ancient Egyptian tombs has been sown and has fructified. There seems no foundation for this statement. It is to be feared that Sir Gardner Wilkinson unwittingly lent his name to the propaganda of this now discredited legend. In his great work, Sir Gardner remarks that in the sepulchres of Thebes grains of corn (wheat) and other seeds, have been found entire and preserved as if fresh from the soil. This is no doubt quite true: the soil of Egypt is exceedingly dry, and

preserves organic matter from chemical changes in a manner which dwellers in damper climates find it difficult to realize. Moreover, these grains and seeds were preserved in pits hewn in the rock and sunk to depths ranging from fifteen to seventy feet. It is well known that at certain depths grain will not germinate, and it is easy to perceive that grain preserved under such conditions might retain its original shape intact, and show no traces of sprouting. Sir Gardner goes further than this and expresses the belief that wheat found in such tombs would sprout if sown under suitable conditions, though he did not claim to have personally verified any such case. As a matter of fact, no case of mummy wheat germinating has ever been established. On the contrary, Unger, who took home several well-preserved specimens of wheat and barley from ancient tombs, had no success in his carefully conducted experiments. Many other Egyptologists have tested the germinative power of wheat found in tombs of undoubted antiquity, but always with negative results. The only successful experiment of this kind, that made by an Austrian nobleman, Count Sternberg, is open to grave doubt. The count's good faith is beyond question, but the grains of wheat he sowed on his estate in Bohemia, a few of which did actually sprout, were not found by him, but were given him by a friend who had brought them from Egypt, and who believed that they came from a mummy's sarcophagus.

Assuming this to be the case, there is no proof that they were placed there in the days of the Pharaohs. It is notorious that the class of Arabs who guide travellers to the tombs and hunt up an-

tiquities for them, are more eager for business than scrupulous in obtaining it. The legend of mummy wheat has had no more strenuous propagators than these people. One European traveller was taken to an ancient tomb, where a newly broken sarcophagus was triumphantly shown him inside of which lay some handfuls of maize. As this cereal was unknown in Egypt until recent times, its presence in this case sufficiently explains how mummy wheat has been found which will germinate. Judging by the experiments of competent and unbiased scientists it may be taken for granted that wheat grains, however carefully preserved, lose their germinative power in the course of a few years; a term of four years has been given as a maximum by some experimenters, but this is admittedly hypothetical.

Transplanted to America, the germinated mummy-wheat legend has grown to marvellous proportions through the agency of the daily newspapers, those fruitful sources of popular misinformation. The idea of growing wheat from seed found in Egyptian ruins evidently appeals with much force to the imaginations of those whose duty and pleasure it is to prepare the choice literature which appears in the American Sunday newspapers. At irregular intervals, therefore, the wonderful tale of wheat grown from ancient seed is printed in these journals with such an amount of exact detail and corroborative incident as to make it seem exceedingly plausible. Usually the scene of the strange development is laid in some remote and seldom-heard-of village not easily reached by the searcher after truth if he were inclined to trace newspaper sensations to their origin in fact. Full names of all persons concerned are given and much circum-

stantial evidence is adduced with no sparing use of pseudo-scientific terms to give the whole an appearance of the exact truth. Doubtless the writers mightily enjoy the preparation of these fanciful occurrences, and many of them embellish their tales with further particulars, adding as much as they dare to the wonderful fact itself by relating to what remarkable height the wheat grew and what curious grains it bore. It is quite probable that many readers of this perennial hoax take it in sober earnest and are greatly impressed thereby.

Recently the author of one of these ancient seed fables overshot the mark inadvertently by failing to learn the meaning of the word corn. In America corn is understood as maize; elsewhere it means grain of any sort. The Chicago newspaper writer had read of the mummy-seed legend, but the word "corn" was used therein instead of wheat. He naturally concluded that the ancient seed was identical with Indian corn, and, not knowing that maize is of American origin and was introduced into the old world after the discovery of the new, he wrote a most marvellous story based upon his error. In a Pennsylvania town a reverend gentleman retired from the ministry had received a package of grain from a friend who had recently returned from a visit to Egypt. This grain had been found in a sealed package in "Egyptian ruins known to have been covered a thousand years before the birth of Christ." The reverend person planted the seed in his garden, and truly astounding was the crop! Corn-stalks fourteen feet high, with ears nearly two feet long, and grains blood red in colour came up. Further, singular worms developed on the stalks, having

the appearance of "diminutive horned devils." These, if removed to other "corn" of the ordinary sort, either died or "managed to get back in some way to the Egyptian stalks, where they can alone secure sustenance." Such, with many embellishments, is the latest development of the mummy-wheat legend under favourable conditions, given to the public through the medium of the daily newspaper, in the form of a special telegram from the scene of the marvellous occurrence, with headlines almost as tall as the miraculous stalks so accurately and truthfully described in the context.

Biblical references to "corn" are plentiful and familiar, and wheat is specifically mentioned in many places in the Scripture. In Samuel xii, 17: "Is it not wheat harvest to-day?" From Job xxxi, 40: "Let thistles grow instead of wheat and cockle instead of barley." Verse sixteen of the eighty-first Psalm contains this reference: "He should have fed them also with the finest of the wheat." Psalm cxlvii, verse fourteen, contains the following: "He maketh peace in thy borders and filleth thee with the finest of the wheat." Twice in Jeremiah is wheat spoken of: "They have sown wheat, but shall reap thorns" (Jer. xii, 13); "What is the chaff to the wheat? saith the Lord" (Jer. xxiii, 28). In the New Testament the word wheat is often used. In Matthew there is a reference to the thrashing process of the time: "Whose fan is in his hand and he will thoroughly purge his floor and gather his wheat into the garner" (Matt. iii, 12). Again, in Matthew xiii, 25: "But while men slept, his enemy came and sowed tares among the wheat and went his way." In Luke xxii, 31: "And the Lord said, Simon, Simon,

behold, Satan hath desired to have you, that he may sift you as wheat." In John xii, 24: "Verily, verily I say unto you, except a corn of wheat fall into the ground and die, it abideth alone; but if it die, it bringeth forth much fruit." In Acts xxvii, 38: "And when they had eaten enough they lightened the ship, and cast out the wheat into the sea."

Finally, wheat is honoured above all other cereals by being used to elucidate and explain the Resurrection in the fifteenth chapter of I Corinthians: "And that which thou sowest, thou sowest not that body that shall be, but bare grain it may chance of wheat or some other grain." "So also is the resurrection of the dead." "It is sown a natural body; it is raised a spiritual body."

From the very cradle of the human race wheat has taken its beginning. Its origin antedates all known languages, and it is older than the oldest civilization. Its history is contemporaneous with that of the recipient of its benefits, and it will doubtless abide with mankind until he no longer tenants the earth.

CHAPTER IV

Wheat in modern times—The United Kingdom's supplies and requirements—Wheat in France, Germany, Russia, and other European countries —The world's wheat crop—India as a wheat producer

To relate in detail the history of wheat growing in the various countries of Europe would be a long story and full of repetition. Spreading

with the growth of civilization, wherever man emerged from barbarism, wheat followed in his footsteps and rewarded his crude labour with its more or less bountiful harvest. As knowledge grew and agricultural methods improved, wheat came into greater use as the favoured of cereals, and as the ingenuity of man found better methods of grinding, the wonderful berry responded by



A Budapest Elevator.

giving up more and more of its secrets. In another chapter the development of milling processes will be described, and the achievements of modern machinery in treating wheat will be related, but throughout all this progress the wheat

berry from the beginning has held within itself the essential qualities necessary for an ideal food, and has given them up only in return for intelligent and scientific experiment. It has been the benignant sphinx of the ages, offering fruitful reward for continued effort.

Speaking of wheat in Europe in modern times, a review of its production during the past three decades shows less extraordinary changes probably than many would expect; some of these changes are, however, very remarkable. For instance, thirty years ago the United Kingdom produced 120 million bushels of home-grown wheat, and imported only 64 million bushels; in 1901 the home production was only 55 million bushels, and the imports of wheat and flour were 186 million bushels, the area under wheat having decreased from 3,760,000 acres in 1870 to 1,740,000 acres in 1901.

Spain is another country which has undergone a complete change in this respect. Thirty years ago Spanish wheat was exported in quite important quantities, especially to England. To-day Spain is an importer of foreign wheat, usually requiring about 8 million bushels annually. Most of the other countries, however, have increased their growth of wheat, although by no means in the ratio that has been required by the increase in the population, and the consequent greater number of bread-eaters. Russia is, perhaps, the only exception.

The competition of American wheat, especially in the last ten years, and of Argentina wheat within the last seven years, has effectually killed wheat growing in England except for the sake of the straw. The thin edge of the wedge of pro-

tection is believed by many to have been placed in position recently by the reimposition of the registration fee of 3d. per hundredweight, but it may be regarded as very doubtful whether England will ever return to the principle of protection pure and simple; indeed, it is quite probable that one of the first acts of the Liberal Government, should it return to power, would be to abolish this tax, which, it cannot be disguised, is obnoxious to the masses.

Thirty years ago Russia was England's chief source of supply. The changes which have taken place in this respect are shown in the following comparison of the imports into the United Kingdom in the year 1872 and in 1900:

	1872.	1900.
Russia.....	Quarters. 4,168,000	Quarters. 1,031,000
United States	2,030,000	13,561,000
Germany	910,000	439,000
France	660,000	252,000
Egypt.....	536,000	None.
Canada.....	400,000	1,877,000
Argentina	None.	4,322,000
Spain.....	130,000	None.
Others.....	685,000	1,708,000
Total.....	9,519,000	23,190,000

France in 1872 exported a large quantity of flour without the aid of any bounty system. Since then the stress of foreign competition has led the Government, in deference to the demands of the agriculturists, to gradually raise the import duty from a nominal fee to a prohibitory tax of \$2.92 per 480 pounds. The result of this tax (which is

temporarily suspended when the harvest fails, as in 1897), has not been to increase the area under wheat, which has remained for many years at about seventeen million acres, but better farming methods, improved seed wheat, and an increased use of artificial manures, have combined to raise the average yield per acre from 15 bushels to 20 bushels. The result is that, with an ordinary good yield, France now produces more wheat than she needs to feed the home population; and prices have been very depressed in recent years, being sometimes very little above the level in England, in spite of the duty. Various measures have been suggested to the French Government for the raising of prices to a more remunerative level, but for the most part they have not been practical, and the scheme adopted—that of giving a rebate of the duty on wheat if an equal quantity of flour and offal be exported—has led to no improvement. In course of time, therefore, it may be expected that French farmers will turn their attention to other and more profitable products.

Germany is another country which has thought fit to protect its farmers from the wholesale competition of foreign wheat. In Germany the minimum duty is about \$1.80 per 480 pounds, and the result has been to somewhat increase the home production, which in good years now reaches 150 million bushels, or 50 per cent more than the production a quarter of a century ago. The home consumption has, however, increased to a far greater extent, and now amounts to about 200 million bushels. Germany is, however, a rye-eating country; the ordinary rye production being 320 million bushels and the consumption

about 350 million bushels. Since 1891 the consumption of wheat per capita has, however, increased somewhat, for the following reasons. In 1891 there was a disastrous failure of the Russian rye crop, and also a partial failure of the German crop. This caused the German Government to use more wheaten flour in the bread supplied to the army, with the result that there is now a more general demand for wheaten flour than formerly.

It should be explained that Germany is usually both an exporting and an importing country in regard to wheat. The customs laws permit an equal quantity of foreign wheat to be imported duty free to the home-grown wheat exported. Much of the wheat grown in Germany is a soft variety, which finds a sale in Scandinavia and England, as much as 12 million bushels being sometimes exported in a single year, but Germany always requires 32 million bushels of foreign wheat to supplement the home production. The year 1901 was an exceptional one in this respect, for the failure of the crop led to an importation of a net quantity of 80 million bushels, which established a record.

The change in Germany's wheat production is shown by the following comparison:

1879.	Crop.....	105,000,000	bushels.
	Net imports.....	2,000,000	"
	Total.....	107,000,000	"
1900.	Crop.....	152,000,000	"
	Net imports.....	48,000,000	"
	Total.....	200,000,000	"

Similar figures for France give the following result:

1872.	Crop.....	332,000,000	bushels.
	Net imports.....	4,000,000	"
	Total.....	336,000,000	"
1900.	Crop.....	325,000,000	"
	Net imports.....	5,000,000	"
	Total.....	330,000,000	"

France, therefore, is at a standstill, so to speak, in regard to her wheat trade, although, as already explained, the farming methods have improved, and given a good crop (that of 1900 was a relatively poor one) the production would exceed the home demand.

Russia is the country in which the most remarkable changes have been made, thanks to the competition of American wheat. In the five years from 1877 to 1881 the average wheat production was 210 million bushels, and the average yearly exports 50 million bushels. For the four years from 1893 to 1896 the officially recorded production averaged 425 million bushels per annum, and the exports 120 million bushels per annum. For the four years from 1898 to 1901 inclusive the average production, according to the official statements, has been 440 million bushels, but the average yearly exports during this period have been only 72 million bushels. It is quite clear that if an average crop of 425 million bushels in the four years ended 1896 yielded a surplus of 120 million bushels per annum, an average crop of 440 million bushels in recent years should have resulted in a still greater surplus; whereas, as we see, the actual exports were 48 million bushels per an-

num less. Thus it is that much discredit attaches to the received official estimates in Russia, the commercial estimates of the crops for the last four years not exceeding 390 million bushels per annum. It is a fact, however, that great economic changes have taken place in Russia within the past twenty years. Manufactures have largely increased, and the population likewise, with the result that wheaten flour is consumed to a larger extent than ever before. It is perhaps natural that in an agricultural country like Russia the greatest efforts to combat the American competition should have been made. Large as has been the increase in Russian wheat production, it still falls behind the progress made in the United States, even if we accept the Russian official estimates of the crops, which, as already said, are open to much doubt. The comparative progress made by the two countries may best be shown as follows:

Russia

	Bushels.
Average wheat crop five years, 1877 to 1881.....	210,000,000
Four years, 1897 to 1900.....	<u>440,000,000</u>
Increase.....	230,000,000

United States

	Bushels.
Average crop five years, 1877 to 1881.....	430,000,000
Four years, 1897 to 1900.....	<u>675,000,000</u>
Increase.....	245,000,000

It was the fashion among certain authorities in Europe twelve years ago to believe that the increase in the population in America would soon outrun the increase in wheat production. This was at a time when the average yearly exports

of wheat and flour from the United States were only 110 million bushels. In 1901, however, the record quantity of 235 million bushels was exported from the United States, and now, instead of attempting to foretell the period when America will become an importer of wheat, the British are asking themselves whether the United States is not overdoing the business of wheat production.

To return to Russia. It may not be generally known that this country is fully up to America, France, and England in the dissemination of official accounts relating to crops, stocks, and prices. Every week there is published in St. Petersburg what is called the *Messenger of Finance*, an official organ which gives a weekly record of commercial and agricultural matters. Not only are all the local markets reported, but voluminous reports of foreign market movements are also given. Unfortunately, the paper is printed in the Russian language, which limits the number of readers outside Russia.

Russia has for some years been making every effort to improve its agriculture. Some ten years ago the Government assisted in the erection of grain elevators on the American plan, along the lines of the Southern Railway, as well as at Odessa and other southern ports. So far, no attempt at grading and inspecting the wheat has been successful. Most Russian wheat is sold on sample for Great Britain, and complaints have been very frequent of late years of the fraudulent admixture of cockle and screenings with the wheat destined for shipment. Endeavours have been made without success, so far, to get Russian wheat sold on a 5 per cent extraneous matter basis; but as

Roumania has recently adopted this method, it is not unlikely that Russia will soon follow.

There is another point in connection with the Russian wheat trade which is worth noting. For some years a system of state aid, in the shape of loans from the state bank on wheat in store on the railways (which are state property) has been in vogue, the idea being to enable farmers to hold their wheat whenever they desire to do so. In 1888-'89 Russia's exports overtopped those of the United States, being in that season 110 million bushels as compared with 90 million bushels. Since then, however, Russia has fallen behind considerably, the returns for 1901 showing only 82 million bushels exported from that country, compared with 235 million bushels from the United States.

With regard to the future of wheat-growing in Russia, much is possible. At present, the system of farming is to a great extent primitive. There are about 42 million acres under wheat and the average yield per acre is not more than ten and one-half bushels. By the use of artificial manure Russia could probably add fifty per cent to its production of wheat, in which case she would easily resume her ancient place as the "Granary of Europe." With the exception of India, Russia obtains the lowest yield per acre from her wheat-fields. The comparison of the average yields for the various principal countries is as follows:

India.....	10	bushels	per	acre.
Russia.....	10½	"	"	"
Roumania	17	"	"	"
Hungary.....	17	"	"	"
France.....	20	"	"	"
Germany.....	27	"	"	"
England.....	30	"	"	"

Roumania has made little progress as a wheat producer during the last quarter of a century. Seventy million bushels is a maximum crop, and this was reached in 1901. Maize is the chief product of the country, this crop having reached 123 million bushels in 1901.

Perhaps a clear method of showing the progress of wheat production in Europe in the last twenty years will be to give the yield as officially returned in each of the principal countries in 1880, 1890, and 1900. This is given in the following statement:

European Wheat Production

	1900.	1890.	1880.
France,.....	Quarters.* 40,650,000	Quarters.* 41,120,000	Quarters. * 35,000,000
Russia.....	53,000,000	35,000,000	25,000,000
Germany	19,500,000	13,000,000	11,000,000
United Kingdom..	6,800,000	9,500,000	9,500,000
Roumania	6,750,000	6,500,000	4,500,000
Austria-Hungary ..	24,100,000	24,150,000	21,000,000
Italy.....	14,500,000	16,000,000	13,000,000
Others.....	24,750,000	24,000,000	20,000,000
Total.....	190,050,000	169,270,000	139,000,000

From the above it will be seen that all the countries named have gained in the production of wheat since 1880 except the United Kingdom, which shows a loss of nearly 30 per cent compared with the returns for both of the previous decades.

In the next tabulated statement is given the production in each country for the six years ending 1901, and the present estimated consumption for each country:

* A quarter of wheat = 8 bushels, or 480 pounds.

The European Wheat Crop
(In quarters of 480 pounds, 000 omitted)

Estimated consump- tion.	1901. Qrs.	1900. Qrs.	1899. Qrs.	1898. Qrs.	1897. Qrs.	1896. Qrs.
23,000 { Austria.....	5,500	5,100	6,200	5,800	4,300	5,200
Hungary.....	17,250	19,000	18,750	17,500	12,000	17,500
6,500 Belgium.....	1,500	1,500	1,500	1,750	2,000	2,000
2,750 Bulgaria.....	4,000	3,000	3,500	5,000	4,000	6,250
750 Denmark.....	250	325	500	500	500	500
43,250 France.....	38,000	40,650	45,750	45,500	30,000	43,000
24,000 Germany.....	12,000	19,500	19,700	18,800	14,500	14,800
1,500 Greece.....	650	750	750	750	650	750
2,750 Holland.....	650	500	650	600	650	750
20,000 Italy.....	16,000	14,500	16,750	16,500	10,000	17,500
750 Portugal.....	600	500	500	750	850	500
4,000 Roumania.....	8,750	6,750	3,250	7,000	4,500	8,625
40,000 Russia.....	43,000	41,000	43,000	44,000	38,500	45,500
7,000 Caucasus.....	7,000	6,000	6,500	6,000	3,750	5,750
1,000 Servia.....	1,250	1,000	1,650	1,500	1,650	1,250
13,000 Spain.....	14,000	12,250	11,900	15,000	12,500	10,000
1,250 Sweden.....	500	500	500	550	500	500
2,500 Switzerland.....	500	500	500	500	500	600
6,000 Turkey (Europe).....	5,000	4,000	3,000	3,500	3,500	5,000
30,750 United Kingdom.....	7,000	6,800	8,250	10,000	7,000	7,250
223,750 Total for Europe.....	183,400	185,725	193,100	201,500	151,850	193,225
						139,000

In order to complete the showing it may be well to give the corrected returns for the whole world's wheat production in the same years, dividing the European from the non-European. This is shown in the following statement, the figures being quarters of 480 pounds, 000 being omitted:

The World's Wheat Crop

	1901.	1900.	1899.	1898.	1897.	1896.	1890.
European.....	183,400	185,125	193,100	201,500	151,850	193,225	139,000
Non-European.....	167,500	139,000	156,100	168,800	139,800	114,450	119,000
Total.....	350,900	324,125	349,200	370,300	291,650	307,675	258,000

The present ordinary consumption of wheat in the world is 340 million quarters. Last year it

probably exceeded 350 million quarters because of the extraordinary scarcity of maize, and the consequent increased requirements of wheat in America.

Indian Wheat Crop and Exports

	Crop.	Exports.
	Quarters.	Quarters.
1901.....	31,500,000	1,750,000
1900.....	23,000,000	10,000
1899.....	29,500,000	2,200,000
1898.....	31,000,000	4,500,000
1897.....	24,000,000	550,000
1896.....	25,600,000	450,000
1895.....	32,000,000	2,300,000
1894.....	31,500,000	1,600,000
1893.....	33,500,000	2,800,000
1892.....	26,000,000	3,500,000
1891.....	32,250,000	7,050,000
1890.....	28,750,000	3,300,000
1889.....	30,000,000	3,200,000
1888.....	33,000,000	4,100,000
1887.....	29,750,000	3,100,000
1886.....	36,000,000	5,200,000
1885.....	35,750,000	4,900,000

India first commenced shipping wheat in any quantity in 1880, when the exports reached 500,000 quarters. After that there was a gradual increase until 1891, the year of the Russian famine, when high prices drew no less than 7,000,000 quarters from India. Since 1891 the movement has gradually decreased, and in 1896 the failure of the crop led to an importation of 150,000 quarters of foreign wheat, a circumstance hitherto unheard of. The decline in the price of silver and the fall in the exchange value of the rupee

assisted the export movement, but India's wheat history shows that the crop is a precarious one, depending to a very great extent upon the monsoon rains. Perhaps the best guide to a knowledge of the Indian wheat trade is a record of the crops and exports since 1885, which is given on the preceding page.

It is very doubtful whether the returns for former years were as correct as those of the later years. It is probable that the crops in the eighties were overestimated. Certain it is, however, that the home consumption of wheat in India is increasing, partly owing to the increase in the white population, and partly to the spread of western customs in the matter of foods.

CHAPTER V

Britain the great wheat mart—Russian wheat—The great famine—Hunger-bread—Communal farming—The “Mir”—Siberian wheat

IN its international character as the world's food provider, wheat comes to a final reckoning in the markets of Great Britain. Before that point of observation, the world's wheat crops pass in review. It is the great clearing-house in which the balances of the wheat-growing countries are adjusted. Britain's own enormous needs, her free markets, open, until recently, without even a nominal tax to the wheat and flour of other nations, her ability to buy and pay for the world's offerings, place her in the eminent position of the nation which makes the wheat price for the rest

of the world. Britain asks the wheat-raisers annually, "How much of your crop do you require for your own use and how much have you to sell?" Other countries are importers of wheat, some of them require large quantities regularly, some of them are intermittent bidders for a portion of the world's crop, but the United Kingdom is a steady and regular purchaser of wheat and its products; a country of wheat-bread eaters, raising always much less than she consumes, and with characteristic resourcefulness ready at a moment's notice to pay in good red gold for what she needs. The wheat-producers elsewhere who have a surplus to sell compete for her orders, and while she is a close buyer, getting her food supply at the lowest figure, she is a most desirable customer, by reason of her prompt pay and her fairness in dealing. The only bar to her steady advancement of power and influence in this direction is the tax recently levied upon flour and wheat. If this is merely a temporary expedient for the purpose of raising revenue it will have no permanent effect upon her position; if, however, it be the entering wedge for a return to a protective policy, it may mark the beginning of a new era of higher priced bread for her people, and at the same time a decline in the position she has so long and so proudly occupied in the world's wheat markets. Be this as it may, at present the United Kingdom holds the key which unlocks the treasury from which comes the pay of the man who grows wheat the world over.

This being true, the international importance of the wheat-producing countries is measured by British standards. It would be of little consequence to the outside world if Russia raised an

enormous crop of wheat, and consumed it all within her own borders. The amount she ships to Britain, however, affects many nations—the United States, Canada, Argentina, and other wheat-exporting countries. If the consumption of wheat in the United States equalled the amount raised in that country, it would cease to be considered as a factor in the world's markets. In the end Britain practically settles the wheat question so far as exporting countries are concerned; and her requirements are the great factor in determining whether or not a crop is to pay the grower.

In the tables shown in the preceding chapter, which should be carefully considered in order to understand the world's wheat situation, it appears that, among European countries, Russia is foremost in supplying Britain's needs. Thirty years ago Russia was her chief source of supply, but the United States has quite distanced her in the race; Argentina and Canada have also passed her. Later the possibilities of the two latter countries will be considered, but before turning to the western world it will be well to glance at the prospects of European countries becoming important competitors with it for the wheat orders of the United Kingdom.

Germany with an enormous population is both an exporter and importer of wheat, but she will probably have nothing greater to contribute to the international market than the quantity she has already offered. France will do well to raise enough for her own needs. Russia alone has possibilities in this direction. As in other things, this vast country is very much of an enigma, what she might do in the way of wheat production under

favourable circumstances and what she probably will do, handicapped as she is by conditions which are an inherited and constituent part of her agricultural system, are two very different things. Possessed of an enormous area of fertile land capable, under proper cultivation, of producing immense quantities of wheat, and geographically situated within easy access to the European markets, Russia would be a formidable competitor, if it were possible for her to overcome the inertia of an ignorant, improvident, and conservative peasantry, which clings to methods of wheat-growing which are but a slight advance over those in use during the Middle Ages. The acreage is there, the fertility of the soil is great, the farming population is sufficiently large and certainly industrious in its way, but the system is faulty and the implements primitive. So little do the peasants understand farming as it is understood in the western hemisphere, that, in a land capable of producing enormous crops, sufficient not alone for home needs, but also to provide a surplus for shipment abroad, famines are of frequent occurrence.

The great Russian famine of 1891-'92, which was unparalleled both for severity and extent, was the result of crop failures, affecting more or less eighteen governments, extending from Perm in the northeast to Orel in the central west, and comprising some of the best and most productive districts of the empire. These provinces were on both sides of the Volga, and extended westward nearly half-way across Russia, and had at that time a population of about thirty-six millions. While the crop failures were due in a measure to unfavourable weather, the crude agricultural meth-

ods of the peasants were even more responsible for the dreadful situation which prevailed. This was conclusively shown by the existence of a few oases in the desert of barrenness, consisting of estates cultivated by intelligent and progressive landowners, who raised grain by modern methods, using machinery of the latest pattern; on these fair crops were produced in spite of the unfavourable weather.

This famine began in June, 1891, and rumours of the alarming situation in the interior came to St. Petersburg early in the season, but owing to the remoteness of the capital from the scene of suffering, and the lack of news facilities, the reports were easily discredited by certain Government officials then in power who stubbornly refused to admit that anything was wrong. It was some time before the authorities awoke to the actual situation, and by this time considerable quantities of wheat had been exported from the country by the astute grain handlers and wheat speculators, who were well informed as to conditions in the interior and anxious to possess the grain before the truth was generally known. The seaports of the empire were very active during the earlier part of the season, but an imperial ukase forbidding the export of grain put a tardy end to these transactions, and retained at home some part of the scanty crop.

Late in awakening to the situation, the Government at once acted with autocratic power and energy towards the amelioration of the peasants' deplorable condition, but the area affected by the famine was so vast, the number of famine-stricken so great, and the railway communications so inadequate, that, although every possible effort was

made to afford relief, the hardships endured by the peasantry during the autumn, winter, and spring were heart-rending. Many literally starved to death, more died from the effects of fevers brought on by lack of proper food, and the mortality among the children and old people was frightful. Russia was stunned by the overwhelming spread of hunger, disease, and death within her borders, and civilization was shocked to find that in the nineteenth century a famine rivalling in its horrors any of those mentioned in mediæval history could occur, especially in a land renowned for the fertility of its soil. The unfortunate peasantry was reduced to a state of helpless and hopeless dejection. Cows and horses were disposed of at a nominal price in order to obtain the means of prolonging life. In some instances horses were sold for three roubles (\$1.50) or were even killed in order that they might not die of starvation. "Hunger-bread," a horrible compound made from the lebeda weed, mixed with a small portion of



"Hunger-Bread."

rye and chopped straw, bark or even sand, was the common substitute for food in the worst districts. The use of this noxious mixture caused disorders of the stomach which frequently resulted in death. Scurvy, typhus, and small-pox followed in the wake of the famine.

It was found necessary to supply more or less relief to some twenty million people who were destitute and helpless. Systematic aid was furnished from October to August. It was estimated that the amount expended in relieving the distress during this period was not less than \$200,000,000, while the total direct and indirect loss to the empire by reason of the calamity was beyond calculation. Other countries came to the assistance of Russia in her great battle with the army of hunger, the United States leading the list of contributors. The American millers sent a shipload of flour, collected by the agency of the Northwestern Miller, and carried on the steamship Missouri to the relief of the hungry peasants. The city of Philadelphia was conspicuous in sending supplies, and large sums of money were collected in America and despatched to the United States minister at St. Petersburg for private distribution. England also assisted in the relief work. In fact, almost every civilized country did something to aid in saving the unfortunate peasants from starvation. The efforts made by the Russian Government, officially and by individuals, from the emperor himself to his most humble subject, to relieve the distress prevailing in the famine-stricken districts, were very great, but in spite of all, the peasantry in the affected provinces endured horrors which no pen can fully describe. The famine and its after-effects left Russia in an exhausted condition, so far as wheat-growing was concerned. Bereft of seed wheat to a large degree, with horses or cows scarce or in bad condition, and peasant farmers weak and more than usually dispirited, it was plain that the great and fertile empire would be obliged to hus-

band its resources of grain for some years, and that it would take many seasons of plenty to refill her empty store-houses and place her in a position where she could again have something to export. The years immediately succeeding the famine were not particularly favourable for grain-growers, and it is doubtful if Russia has yet entirely recovered from its effects.

Inquiry into the causes of this unexpected, but not surprising, calamity leads to the conclusion that other and more weighty reasons than those usually given at the time (the unfavourable weather of the preceding year) were at the root of it. Fundamentally, the Russian system of communal ownership of land was responsible for the situation, and this institution must inevitably act as a bar to Russia's extension of her wheat-producing powers so long as it exists. A community of Russian peasants called the "Mir" holds lands in common, divides it into lots, and cultivates it. The mir had exhausted itself, and the thirty years which elapsed between the emancipation of the serfs and the year of the great famine had been sufficient to demonstrate that the entire foundation upon which Russian agriculture is based was radically weak, and that the practical result of holding land in common, in Russia at least, was an utter failure. It took thirty years of experiment to solve the problem, and the answer was famine. The peasant will not intelligently and adequately cultivate land which may pass from his possession into the hands of others after a few seasons. On the contrary, he works it for what it will immediately yield, caring little for its future condition, for he does not know how soon the mir may allot it to another.

Twenty million nominal property owners, for such were the famine-stricken peasants, holding in common and clinging tenaciously to large areas of fertile land, fearful above all else of becoming dispossessed of their property interest and of joining an already large and constantly increasing proletariat, yet at the same time begging humbly and piteously for the bare food necessary to maintain existence—this was the strange and anomalous sight which was presented to the world in the naturally arable district lying within the valley of the Volga. That this came about primarily from the defective system under which the land is held is undoubtedly true. It is also true that the Russian peasant does not cultivate



Russian Peasant Ploughing.

the land thoroughly under any circumstances, that his methods are primitive, and his implements mediæval. Still, the force of example might lead him to improve his methods were his individual ambition encouraged by a different

system of ownership. Under the present conditions he sees simply as far as the season's work, which practically ends his individual connection with the land he is tilling.

Fundamentally wrong in its root, the growth of thirty years, which found its flower in a famine, was hampered and hindered by adverse circumstances, too numerous to be referred to here at length. Parasites had fastened themselves upon its body and contributed to its decay. The newly liberated serf, left to himself largely, was free to make his own future, subject, of course, to well-defined limitations; but to the work of development he brought an irresponsible, thriftless, improvident disposition, and a naturally good, but utterly untrained, intellect. He had his hands to himself and his land; he was trained to work, but not to think. Hence the village usurer, the "koulak," the "mir-eater," found a ready victim for his schemes, and, naturally, the peasants, as a class, became subject to the rapacity of the money-lenders, petty officials, small traders, and all the varieties of human vermin which in Russia fatten on the credulity and the financial ignorance and short-sightedness of those who have the capacity to work, but not the understanding to calculate.

Even originally the apportionment of land per head was but small—not more than enough to maintain the peasant in the most primitive manner. As the family grew and the sons arrived at maturity, the land belonging to the commune had to be subdivided, so that each might have a share. Thus, beyond the discouragement of the system itself and the impoverishment worked upon the peasant by the village usurer and others, the

natural reduction of the land which he was permitted to till and enjoy the fruits of, when there were any to enjoy, was great. To-day the Russian peasant clamours above all for more land, even though the land he already has is but half cultivated. It is apparent that the increase in population and consequent reduction in village land per capita would, sooner or later, have brought the peasant perilously near to hunger, even if he had been accustomed to modern methods and machinery. Short crops and partial famines became more and more frequent; the stores, if there existed any, were more continually drawn upon. They reached the danger line, fell below it, and finally became exhausted.

It was common in Russia during the famine to refer to the condition of the peasant as temporary, the result of a bad harvest, and to express the belief that, with favourable weather, he could recover himself. To one who saw the peasants as they then were, it is difficult to discover anything in their state upon which to base any hope of its speedy and permanent amelioration. The famine was the climax of several predecessors, gradually increasing in intensity and extent until the worst was reached. There must be partial famines in Russia every year, and the great one of 1891-'92 would have passed as usual had it not been that it marked the very limit of human endurance, beyond which was death.

The export of grain from Russia does not mean the export of a surplus, but the parting of food needed to sustain life. The famine showed the great, hollow void in the very heart of the empire, and, as long as the present system is continued, all the favourable weather which Provi-

dence can send will be powerless to fill it. The gradual impoverishment of the peasant has been going on for forty years, and the end has arrived. The limit of exportation from the actual means of existence, instead of an exportable surplus, has been reached and passed. Russia must, temporarily at least, retire from her artificial position as an exporter of grain, and turn the products of her fields into her depleted store-houses. She must give her peasants another start and allow them to accumulate a village reserve. As far as one can judge, this policy seems in line with that of the Government.

Since the year of the great famine many reforms have been instituted in Russia. A system of banking, intended to enable the peasants to hold supplies of wheat, has been established, and some lines of elevators have been built. Sufficient time has not elapsed to demonstrate the real value of these reforms; probably they will contribute to a degree in maintaining an agricultural equilibrium, and in preventing a recurrence of the calamity of 1891-'92, but the future of Russia as a contributor to the international wheat markets must, when all is said, depend upon the condition of the grain-grower, his ability to cultivate his land intelligently and with the best results. As long as the mir exists, as long as communal cultivation remains an institution of Russia, and the peasants grow wheat on ground not individually theirs, so long will they continue to scratch the earth's surface in a desultory, primitive fashion, and be satisfied with returns dependent almost entirely upon nature's moods. Under such conditions it seems improbable that Russia will be able to compete successfully with the United States and

Canada in the world's markets. She will doubtless export more or less of her wheat crop, but for her permanent granary Europe must needs look elsewhere.

Much discussion has been given to the possibilities of Siberia as a wheat-producing country. It has been claimed that in time this great territory would re-enforce Russia, and, as a result of the building of the trans-Siberian railway and the settlement of Siberia by emigrants from Russia who are naturally wheat-growers, a great, new, inexhaustible source of wheat supply would come into existence. A few years ago American farmers and millers were greatly concerned over this Siberian possibility and many of them feared that, with the opening of the new territory, there would appear upon the scene a fresh competitor for the position of the world's food purveyor. Time passed, the great railway was built, but as yet neither the Siberian miller nor the Siberian wheat-grower has made his appearance in the markets. What this country can do in the way of wheat production on a large scale is yet to be demonstrated. Possibly the day may come when it will be counted as important in the list of wheat-raisers, but at present this seems too remote for serious consideration, and the future wheat-fields of the world seem to be extending in an altogether different direction. The Asiatic is becoming a wheaten-bread eater; by the time his taste for the bread of civilization is fully developed the Siberian miller may find a market in China and Japan for his product, if he is able to compete with the American miller of the Pacific coast, who is now exploiting this field successfully. As far as Europe is concerned, there seems no prospect, remote or immediate, that Si-

berian wheat and flour will find its way thither in any considerable quantities.

CHAPTER VI

Argentina—Natural advantages—Methods of growing—
Character of berry and its grower—Export trade—
Future possibilities

HAVING considered briefly the wheat situation in Europe and the possibilities of the world's supplies in that direction, we turn naturally towards the west to learn something of the sources of food afforded by the newer countries, and to ascertain to what extent the increasing millions of bread-eaters in Christendom may rely for their favourite cereal on the lands of the western hemisphere. Immediately we are impressed with the fact that we are reaching that portion of the globe where the home consumption still bears such a small relation to the amount of wheat produced that exportation is a natural and necessary procedure. Indeed it is apparent that nature has passed over the European fields, as practically utilized to the limit of their possibilities, and has opened in the new world far vaster territories suitable to wheat production from which she designs to supply the increasing needs of mankind.

First in order, but not in importance, is Argentina, South America. Before moving northward, let us see what this section of the earth's surface has done and can probably do to help in the great work of furnishing bread for others than itself. Argentina, or "La República Argen-

tina," as the Argentinos prefer to call their country, certainly possesses great natural advantages as a wheat-grower. It has extensive prairies very similar to those of Minnesota and Dakota. These lands are easily worked and produce fair yields of wheat. Moreover, land is cheap, and even without renting or buying it a colonist who has a little money, enough to provide horses and a few implements and to feed himself and his family for a time, can procure land to work on shares. For this he has no rent to pay in cash. But when the harvest is gathered he delivers one-third, or whatever the agreed proportion may be, to the owner of the land. Owing to the mild climate the living expenses of the colonist may be reduced to a very low figure. Many colonists start with the intention of working the land for the period of the lease, usually five or seven years, and then of seeking "green fields and pastures new." For this reason they do not waste either time or money on their habitations. Many of them are satisfied to live in hovels made by drying the soil, a sort of adobe hut. Perhaps the colonist will indulge in the luxury of a galvanized iron roof, a door, and a window. These he can easily carry away with him when he moves to other fields. These are the possibilities of cheap wheat production in Argentina, and much of the wheat grown there is produced under the conditions mentioned. On the other hand, there are many colonists who own or permanently occupy the lands they cultivate and who have a higher standard of living.

The wheat-growing districts of the Argentine Republic lie between the 30th and 40th degrees of south latitude. The seasons are therefore the reverse of those in the United States, and greater

cold is experienced in the southern than in the northern part of the country. Planting is done from May to August according to the locality, and the season and harvesting is done in December and January. The heat in the Argentine summer is about the same as the heat in July and August in the central portion of the United States. In the Argentine winter, from May until October, a lower temperature prevails and rains are more general. In the northern and central portions of the Argentine Republic snow is seldom seen on the plains, although in the southern districts, for instance, around Bahia Blanca, snow is not unusual. The winter is not sufficiently severe in any part of the country to make it necessary to house cattle. This fact contributes to reduce the cost of farming as compared, for instance, with the cost of farming in Minnesota or the Dakotas, where live stock has to be housed and fed for a certain period every winter. But nature, which is kind to the Argentinos in this respect, is rather unpleasant to them in other ways. For example, in the matter of rainfall. It has been the unfortunate experience of the Argentine farmer on many occasions to suffer either from drought during growing time or from rain during harvest. Extensive hailstorms also occur, so that in many districts insurance against damage by hail is generally secured by the colonists.

A natural advantage favouring the growing of wheat in the Argentine is the proximity of the wheat-fields to the seaboard or the great navigable stream, the Plate. This extraordinary river, which is something like one hundred miles wide at its mouth, is formed by the confluence of two streams, the Paraná and the Uruguay.

These come together not far above the city of Buenos Aires. They form the southern, eastern, and western boundaries of one of the Argentine provinces bearing the name of Entre Ríos, "Between Rivers." The Paraná, which forms the eastern border line of the great wheat-growing province of Santa Fé, is navigable for large steamers as far up as Rosario, the great interior wheat port, and for sailing vessels and even for steamers of considerable size for some distance farther up. Rosario is about one hundred and ninety miles north of Buenos Aires, while Colastiné, the port of the city of Santa Fé, is over two hundred miles farther inland. Thus for four hundred miles inland the Plate and the Paraná are navigable for large vessels, and all the Argentine wheat-fields are practically on or very near the seaboard. None of the wheat-fields of the province of Santa Fé, for instance, are over two hundred miles from the port of Colastiné. About three hundred miles would be the longest railway haul necessary for any of the Argentine wheat. This would more than cover the distance from deep water to Trenque Lauquen, in the interior of the province of Buenos Aires, or to Villa María, in the province of Córdoba. These towns are about the remotest points from deep water from which wheat is exported. If ocean steamers had easy access to the great lakes, as they should have, the wheat-grower in Minnesota would be situated about as advantageously with respect to proximity to the seaboard as the Argentine farmer, except that the Argentine water-way is never obstructed by ice.

The Argentine is now well supplied with railways. The lines of the Central Argentine, the Western of Buenos Aires, the Santa Fé, the Buenos

Aires and Rosario, and the Entre Ríos railways, with numerous less important lines, traverse the wheat-fields of the western and northern districts, while the Great Southern Railway covers



Loading Wheat, Argentina.

the southern districts. The latter is the most extensive railway undertaking in the Argentine. The head office of the company is in London. It has over two thousand miles of line in operation, and employs about 11,000 men, and, according to the last returns available, has an equipment of 247 engines, 461 passenger cars, and 8,521 freight cars. In the nineties the growth of traffic in wheat, maize, and other commodities was so great and unexpected that the railway companies were wholly unable to cope with it, and wheat-shippers frequently had to see their wheat lying unpro-

tected at country stations for weeks before they could secure cars. Now the situation is much improved in this respect. Delays are rare, except in the busy season, and the wheat-shipper is well served by the railways, although the freight rates charged on wheat are higher than those current for similar distances in the United States.

The grasshoppers which in past years have caused such havoc to the Argentine wheat crop have been vigorously fought both by public and private enterprise. Entomologists have been brought to the country from the United States and elsewhere to study the habits of the locusts and the best methods of exterminating them, with the result that the damage caused by these pests of late years has been slight.

Wheat-growing received its great impetus in the Argentine about 1890, at the time of the Baring failure. Prior to that time the country had been having a prosperous period, and there was an era of great extravagance. Many land-owners borrowed money on the security of their land, the loans being payable in gold. After the financial crash much of the mortgaged land was thrown on the market at very low prices, and its cheapness led to the cultivation of wheat on a large scale. In 1890 the Argentine, which but a few years before had imported flour from the United States, produced a crop of wheat of over 30 million bushels. At that time the population of the country was about 4,000,000. A cause that contributed largely to the increase of wheat-growing in the Argentine during this and succeeding years was the heavy gold premium. The wheat-shipper received gold for his wheat, and paid for it in the depreciated paper currency.

of the country. In 1901 the gold dollar was worth 3.87 paper dollars. Thus the farmer who received the equivalent of 40 cents per bushel gold for his wheat at the farm actually received \$1.54 per bushel in paper currency. This seemed like a high price and really was a high price, because he paid for his labour and for many articles of consumption in paper money, and at prices that were altogether out of proportion to the premium on gold. That is, while the wheat-grower received a greatly enhanced price for his wheat in paper money, owing to the high premium on gold, he was not obliged to pay as high prices relatively for labour and articles of domestic production. On such implements as harvesters or other imported machinery he certainly had to pay a price based on the full premium, but still he derived a very considerable advantage from the monetary condition that prevailed in the nineties.

Under the stimulus of these influences, and helped by an increasing immigration that received liberal support from the state, the wheat crops of the Argentine showed progressive increases till in 1893 the crop reached the respectable total of 90 million bushels. Since that year it has fluctuated, owing largely to weather damage. The crop of 1889-1900, as reported by Ernesto Danvers, amounted to 104,524,000 bushels.

Farming methods in the Argentine are still somewhat primitive, particularly as to the method of preparing the ground and of caring for the wheat till it is sold. Thus the Buenos Aires correspondent of the Northwestern Miller, writing in April, 1902, of the Argentine farmers, says: "They simply scratch the surface, and then expect the seed to take root and the plant to be

strong and healthy. They are a lazy crowd. They are always on the make and dread expenditure. They do not take care in preparing the land, as they have not the sense to see that if the land is well prepared, and a little more time and money spent in doing this, the returns will be greater and they will benefit accordingly." Much agricultural machinery is shipped to the Argentine from the United States. American harvesters are in general use, though thrashing-machines of English manufacture seem to be given the preference. Light ploughing is the rule, and even this is not very well done. There is a gradual improvement going on in the use of better farming appliances, but it is very slow.

Much of the land is very weedy, and the weeds in many cases have the effect of causing the grain to heat in the stack. The soil is generally fertile, with a subsoil of clay that holds the moisture, and enables the land to pass through pretty severe drought, without serious damage to the wheat. The yields of wheat vary greatly according to the district, the methods of farming, and to the season. For the crop of 1899-1900 the average yield of wheat in the provinces of Santa Fé, Buenos Aires, Cordova, and Entre Ríos was approximately $12\frac{1}{2}$ bushels. Formerly the average yield of wheat in Santa Fé, which was the first province to come into prominence as a wheat-grower, was placed at 10 to 11 bushels. The improved yield is no doubt a result of improved methods of farming. Owing to the partial crop failures during the last few years, the average yield per acre has been considerably reduced. A recent estimate by the Argentine Minister of Agriculture places the yield for the whole country, for the years 1895 to 1901

inclusive, at about 6 to 7 bushels per acre. Among the causes for crop failure are enumerated rust, blight, mildew, hailstorms, frost, torrential rains, severe drought, and locust depredations. Much damage is caused to the Argentine wheat crop every year after it is harvested by the lack of suitable granaries on the farm and of granaries or elevators at the country railway stations, and even at the ports of shipment. The experiment of erecting a few country elevators on the American plan, made by one or two of the Argentine railways some years ago, was such a complete failure that it has not since been repeated. The Argentine farmer seems to prefer storing his wheat on the ground in sacks, perhaps covered by a tarpaulin and perhaps not, rather than pay elevator charges. It can be easily demonstrated that the loss and damage caused to the Argentine wheat crop each year through lack of suitable protection after harvest is far in excess of the cost of properly warehousing it. But each farmer seems to prefer to take his chances in this respect. Even in the case of large farms, operated by English land companies, wheat is stored on the ground in sacks, although some protection is afforded by tarpaulins. In a country as subject to sudden and violent rainfalls as the Argentine, such a method of handling grain must inevitably result in serious damage.

The wheat chiefly exported from the Argentine, and known in the European market as Santa Fé or Plate wheat, has a berry resembling American red winter wheat in appearance. The natural weight of the wheat varies in different seasons. In 1902 many cargoes of Plate wheat offered in London ran as high as 62 and 63 pounds to the bushel.

The wheat berry when cut open is floury rather than flinty in appearance, and it produces flour of good colour. Yet it is not lacking in gluten, and the gluten has excellent properties of expansion. Millers, however, often find a great difference in the milling value of different lots of Argentine wheat, and this no doubt is owing largely to damage received by the wheat after being harvested. The damage, in many cases, does not show on an examination of the berry. It often happens that Argentine wheat which has received a good soaking at the farm or at the shipping station, from rain, will afterward be restored to an apparently perfect condition by being handled over. This is done either by the peons or workmen who spread the wheat out on the ground on tarpaulins and then turn it over with shovels, or by the elevators at the ports, which run it over. There are many days in the Argentine when there is a good air; Buenos Aires means "good airs." If handled over on one of these days when there is a good drying air, combined with warm sunshine, damp wheat will dry very rapidly, and after drying will bear little trace outwardly of its former wet condition, although the wetting and subsequent drying have an injurious effect on the milling properties of the grain.

Some of the wheat grown in the south is flinty and has almost the appearance of the hard Fife wheat grown in Dakota or Manitoba. Not a little macaroni wheat, known locally as Candeal, is grown in the Argentine. It has a long berry, is light in colour and very hard and flinty in texture, like the rice-wheat or "goose-wheat" grown in the United States. This is used for making semolina or macaroni, for which there is a consider-

able demand from the Italian colonists. A variety of wheat that is extensively used by the Argentine millers is the Frances or French wheat. This is softer than the Barletta wheat. Like soft wheat elsewhere, it gives a large yield, but is more subject to weather damage than the hard sorts. A few other kinds of wheat are grown, but those here named are the wheats chiefly seen in the Argentine.

Nearly all nationalities are represented among the Argentine wheat-growers. There are colonies of French, German, and Russian settlers. For the most part these nationalities keep to themselves, and to a great extent they each retain the native customs and modes of living and of farming. At Carcaraná, a little country place about an hour and a half by rail from Rosario, there are many natives of the United States. A colony that has attracted considerable attention is the Welsh colony at Chubut. This little colony, situated far south of any Argentine town and remote from the railways leading to the capital, was connected with the seacoast by a narrow-gauge railway about forty-five miles long. The Welsh raised good wheat, but being discouraged by a series of floods and disasters in 1902, they determined to migrate to Canada. Some of the Argentine papers reproached the government rather strongly for failing to help the Welsh, and for not making it an object to them to remain in the Argentine. The bulk of the wheat produced in the Argentine is raised by Italian colonists; therefore in considering the character of the Argentine wheat-grower, all but the Italian can be left out of the account. The Italian lives cheaply, is frugal and thrifty, and very often

amasses a fair competence. To put it mildly, he farms unscientifically, and he likes to idle when work is not pressing. But at harvest-time he is the personification of diligence ; not only himself, but all his female relations, from his daughter to his grandmother. As before mentioned, he is often content to live in a poor apology for a house, and to do without luxuries or even what would be considered necessities by farmers of other countries ; so he makes a very awkward competitor. Shiploads of Italians go over to the Argentine at harvest-time to return to their own land when harvest is over. The number of farmers who own or permanently occupy their own lands seems to be increasing.

Argentina exports bran largely to Brazil, as it is not required in the country to any great extent owing to the abundance of feed afforded by the natural grasses and by the wonderfully prolific alfalfa. It also exports considerable flour to Brazil. Its wheat exports go to Great Britain and the Continent, and a small proportion of flour and bran is shipped to the same destinations. Before 1890 the Argentine wheat exports were inconsiderable, but in that year they amounted to 12,244,240 bushels. By 1893 they had increased to 37,628,640 bushels, and when these exports were followed in 1894 by wheat shipment amounting to 60,026,646 bushels, grain men the world over began to wonder whether at this rate of increase Argentine was to take the leading place as a wheat shipper. The succeeding year, however, showed diminished exports. In 1897 the wheat exports were only 3,801,837 bushels. In 1900 they came up again, and reached 76 million bushels, but in 1901 they fell back to 36 million,

and in the current year, 1902, they are likely to be still less, as the exports for the first three months of 1902 were but 9,538,939 bushels, against 15,954,095 for the first quarter of 1901. The Argentine flour exports have not yet reached large figures. In 1899 Argentina made its largest flour shipments, namely, the equivalent of 679,588 barrels of 196 pounds. But in 1900 the flour exports



Interior of an Argentina Mill.

fell off to 585,177 barrels. The milling capacity of the country is, however, far in excess of local requirements, and the Argentine millers are more and more feeling the stress of local competition, and the necessity for exporting. Some of the more modern mills are suitably situated for the export trade, but the majority of them are at a

disadvantage in this respect, and there are no mills in the country that can compare with the large exporting mills of the United States in size or economy of manufacture. For one thing, the absence of a home demand for bran is a great handicap to milling on a large scale in the Argentine.

In 1896 Kingsland Smith, the special correspondent sent out by the Northwestern Miller to report on wheat-growing in the Argentine, after travelling all over the country, wrote as follows regarding the future of wheat-growing in the Argentine : "I should say that in the next ten years the Argentine wheat crop will show great fluctuations. Some years it will be heavy, and again it will fall off greatly; but at the end of the ten years the crop will not have increased in anything like the same proportions it has in the past." Thus far, the foregoing prediction has proved an accurate forecast. The crops have shown wide fluctuations as indicated by exports varying from under 4 million bushels in 1897 to over 76 million in 1900. Some of the improvements indicated at that time by Kingsland Smith as likely and necessary, such as better elevator facilities at the ports, are now in process of realization. Large elevators of modern construction are being erected at Buenos Aires, so that, with the existing elevators there and at Rosario, the country will be fairly well supplied with port elevators.

As far as can be seen to-day, there will be a gradual growth in the production of wheat in the Argentina, especially as new lands are opened up by railway extension in the south and west; but it will be long, if the time ever comes, when Argen-

tina will occupy a position materially different from her present one as a provider of the world's breadstuffs.

CHAPTER VII

Wheat in the United States—The world's greatest producer—The prophets of the late '50s—Washington as farmer and miller—Western march of wheat—The Ohio limit—Futility of estimating possibilities

• IN the story of the King of Cereals we now come to the chapter which deals with his greatest achievement, that of turning a wilderness inhabited by savages into a vast field of wheat peopled by a civilized and cultivated nation—the development of a great republic, upon which older nations rely in a large and increasing measure for their supply of bread. King Cotton and King Corn have been extolled in song and story, but the glories of good King Wheat, far surpassing those of his fellow monarchs, have not as yet been the theme of the song-maker. Perhaps his subjects have been too busy extending his domains to properly exalt his greatness and beneficence.

The United States now occupies the stage of the world's theatre as the greatest wheat-producing country on the face of the earth, and if we may judge by the average yield per acre, which is far less than that of many other and older countries, it is capable of producing, if the need exists, very much larger crops than even those of its record-breaking year, which was 1901, when it raised 721 million bushels. This need, in order to stimulate Americans to even greater results, must express itself in the form usually best appre-



Thrashing Wheat, America.

ciated by them—the almighty dollar. In other words, if a continued shortage in the world's wheat supply should occur, it would, of course, lead to a material advance in price. This premium would bring out the best America could do in the way of a crop of wheat, and no one can accurately estimate what that would be. The effect of higher prices on wheat production is the unknown factor which throws the wheat-famine prophets out of their reckoning and brings their pessimistic forecasts to nothing.

According to the very exhaustive and perfectly logical reasoning of many of these gentlemen, the consumption of wheat should have caught up with the supply in the United States some years ago. The statistics they presented certainly proved their case, and their deductions were entirely reasonable and quite convincing. Figures ought not to lie, but nevertheless they very often do, and are caught at it. Nearly fifty years ago a worthy gentleman, who was at that time an authority on American wheat, predicted that the limit of the area capable of producing wheat in the United States had been reached. He was quite certain that Ohio was the western extremity of the wheat-producing region, and in his excellent book, *The Wheat Plant*, may be found arguments based on facts in regard to the character of the soil necessary to wheat-growing and the nature of the country west of his limit, which actually proved the logical correctness of his statements. He denounced as vain boasting the claim that the United States could feed the world from its surplus of wheat, and, while admitting that "in a country so extensive as ours we need not fear a failure," he declared that "beyond feeding our great and in-

creasing population we shall not generally have any great surplus." He predicted that the tide of population then moving westward must quickly stop, as it would shortly reach the verge not only of the wheat region, but of the limit of agriculture as well. Then "it must soon return eastward in search of the wheat-producing region." He therefore advised the Ohio farmers, who occupied the western wheat limit, to preserve their lands, husband their resources, and stop the deterioration of the soil by the liberal application of manure and by better tillage.

The *Wheat Plant*, by John H. Klippert, was written in 1859, and, apart from its chapter on the wheat-producing region in the United States, is still regarded as an authority on many of the subjects it treats of. It is a work of some seven hundred pages; a portion of it published in the Ohio Agricultural Report for 1857 caused the entire edition of twenty thousand copies to be absorbed in less than sixty days from publication. The author was no ordinary scribbler, but might well be accepted as a competent authority on the subject of which he wrote, for he was corresponding secretary of the Ohio State Board of Agriculture; member of the Academy of Natural Sciences, Cleveland; honorary member of the Western Academy of Natural Sciences, Cincinnati; and corresponding secretary of the Columbus Scientific Association. He judged shrewdly according to the light of his time. If the Ohio farmers followed his advice in the matter of improving their land and husbanding its resources, they did wisely, and it may be that to the warning given by Klippert is, in some measure, due the fact that Ohio still ranks high in the list of winter-wheat-producing States.

It is to be feared that if Mr. Klippart confidently expected the return of the pilgrims who passed on beyond the borders of Ohio in search of wheat-fields, and waited for them to come back to the limits of his wheat-producing area, he must have grown weary, for these indomitable conquerors of the soil not only journeyed beyond the Mississippi, but their children are now crowding across the Canadian border, and still wheat springs up in their wake. In 1857 Ohio raised 25 million bushels of wheat. The average crop of the State for five years ending 1899 was nearly 35 millions. The total wheat crop of the United States in 1850 was 100 millions; the average crop for five years ending 1899 was 530 millions. In 1850 the United States exported 1 million bushels of wheat and 2 million barrels of flour. In 1901 it exported 178 million bushels of wheat and 19 million barrels of flour. Writing in 1859, Klippart said that unless the yield to the acre was increased "our surplus will by the next census be measured by the algebraic quantity of minus." The author of *The Wheat Plant* was not the last authority on wheat to predict that the limit of production was within sight, and that not only the United States but the world would shortly overtake its supply and experience a wheat famine, and these wrote seriously and sincerely, all with ample data to draw their conclusions from, yet all have been thus far mistaken; not only has the area of possible wheat culture exceeded all expectations, but, as already said, under the impetus of an advance in price, land supposed to have been permanently abandoned for wheat has been found to yield an excellent crop. Advanced methods of agriculture and the liberal application of manure may be



An American Primary Wheat Market.

excellent promoters of satisfactory wheat crops; but to bring forth the best the fields are capable of doing there is nothing so good as a "corner" in wheat and a substantial advance in its price.

The wheat map of the United States shows that forty-three States and Territories raise wheat in considerable quantities. In the New England States, many of the Southern States, and the Middle and most of the Western States it is an important crop. Its growth began with the coming of the first emigrants to the colonies; it has increased with the development and extension of the republic. George Washington was a wheat-raiser and a miller. From the time he married until almost the day of his death there was no concern at Mount Vernon which, perhaps, more occupied his mind than the condition of his wheat crops, the price of flour, and the operations of his mill. He was the greatest landholder in America. No miller of to-day watches the quotations more closely than Washington noted every fluctuation in American and European wheat prices. In 1765 he decided that he ought to give more time "to the growth of wheat and the manufacturing of it into flour." When he returned to Mount Vernon at the close of the war he referred proudly to what he had previously accomplished in wheat culture, and declared that "no wheat that has ever yet fallen under my observation exceeds the wheat which some years ago I cultivated extensively, but which from inattention during my absence of almost nine years from home has got so mixed or degenerated as scarcely to retain any of its original characteristics properly." Wheat has ever been the friend of peace, and in time of war is wont to show its disapproval by becoming demor-

alized. After Washington secured time to put his estate in order, the Mount Vernon brand of flour resumed its value. The year 1795 was Washington's best for flour. He expressed his satisfaction at having sold his product early in the year at the rate of \$12 a barrel on account of the scarcity in Europe. Later he sold more at \$13, and expected it might reach even \$20 a barrel. He exported much of the product of his mill to the West Indies. In the last letter he wrote he said that "as a farmer, wheat and flour are my principal concerns." The first President of the United States was proud of the fact that the famous Mount Vernon brand of flour was synonymous with the finest in the world.

As the tide of emigration moved ever westward, the extension of the wheat area followed it. Wheat is the favourite crop of the pioneer; he can most readily use it for his own purposes, and it always commands money. The wheat of a virgin soil is strong and hardy, but subject to pests, which grow less destructive in older lands. In 1850, as already shown, authorities considered that, so far as wheat was concerned, the westward limit ended with Ohio. It is interesting to note the census returns from the various States in 1840 in comparison with the figures of the present time. The entire wheat crop in 1840 was but 88 million bushels—about one-half of the average crop for five years ending 1899 of Minnesota, the two Dakotas, and Nebraska, and about one-sixth of the average crop of the United States for the same period. California in 1840 was not credited with any wheat, nor was Minnesota. Of course, the Dakotas, Nebraska, Colorado, Washington, Nevada, Idaho, Montana, New Mexico, Oregon,

Utah, Arizona, Wyoming, Kansas, Texas, and Oklahoma were not among the wheat-growing States of that time. Ohio led with over 16 million bushels; she now averages nearly 35 million. Some of the States on the list in 1840 raise less wheat now than then. For instance, a comparison of the average for five years ending 1899 with that of 1840 shows the wheat product of Alabama to have diminished by half; Maine raises less than 10 per cent of the wheat she produced in 1840; Mississippi but 15 per cent; New Hampshire about 6 per cent; New York shrunk from 12 to 7 millions, and Vermont now raises about one-quarter of her 1840 crop. Some of the older and thickly populated States which were important contributors to the total of sixty years ago are still large wheat-producers and show great gains. Maryland has increased her crop three-fold; New Jersey has doubled hers; so also has North Carolina and Tennessee, while Pennsylvania has increased about 80 per cent. Georgia, South Carolina, and Virginia raise practically the same amount as they did in 1840. The great increase among the States on the census list at that time, as compared with 1899, is found in a section then considered beyond the natural western limit for profitable wheat-growing. Illinois now produces on an average nearly nine times, Indiana over six times, Iowa one hundred times, Kentucky more than double, Michigan about ten times, and Missouri fifteen times more than the census returns of 1840.

Even twenty years later, Klippert spoke of the wheat-growing possibilities of these States very slightly. Kentucky and Missouri, he said, "are best adapted to corn, and wheat can never

be regarded as the great staple of either." "Indiana, Illinois, and the 'far west' are painted to us as the great wheat regions to which we are to look



American Country Elevator.

for the wheat to supply the world. The common idea is that this whole region is peculiarly adapted to wheat; but this, like many other popular theo-

ries, may not be strictly correct." Thereupon the excellent gentleman proceeds to prove that these States, by reason of their soils, are not to be relied upon as wheat-producers. "To avoid the evils of winter-killing in Illinois," to quote Klippert, "they have resorted to the culture of spring-wheat, sown on the land where the fall-sowed crop had been winter-killed. This increases the quantity at the expense of the quality, for every one who has observed the quotations of wheat in New York must have observed the depreciation in Illinois wheat." As to Iowa and Wisconsin, which was the limit of the northwestern horizon in Klippert's time, their pretensions were readily brushed aside by quoting the geological survey carried on by order of Congress, which gave excellent reasons why "those Western States cannot be permanently first-rate wheat-lands." It seems almost cruel to the authorities of 1859 to add that in 1901 these two States produced a trifle of some 30 million bushels.

In support of his contention that Ohio marked the western limit of profitable wheat-growing, and that the far west was "mostly a desert, incapable of producing anything, much less good wheat crops," Klippert quoted Professor Henry, secretary of the Smithsonian Institution, who said: "We are nearer the confines of the healthy expansion of our agricultural operations over new ground than those who have not paid definite attention to the subject could readily imagine. The whole space of the west, between the 98th meridian and the Rocky Mountains, denominated the great American plains, is a barren waste, over which the eye may roam to the extent of the visible horizon, with scarcely an object to break

the monotony." Emery's Journal of Agriculture, then published in Chicago, was also quoted by Klippert in support of his argument, and he summed up his conclusions by saying: "This narrows down the wheat region to a small territory, and instead of the vain boast that we can feed the world from our surplus wheat, indicates that we must husband our resources and stop the deterioration of the soil, or we shall soon be importers of wheat instead of exporters."

Apropos of forecasts and prophecies, a very singular instance of the ability of those who are remote from the scene of action to sometimes make a closer estimate of the possibilities than the authority on the spot, is shown in an old letter written from Germany by the father-in-law of Mr. Philip H. Postel, of Mascoutah, Illinois, to him in America. Mr. Postel is still living at the age of eighty-five, and the letter is in his possession. It was written in 1854. Therein the writer advises his son-in-law, then and now a miller, to remove from Illinois and buy all the land he could secure near St. Anthony in Minnesota, where, he was confident, would be situated the future milling and grain centre of the United States. This prophecy seems almost marvellous, for at the time it was made the northwest was quite undeveloped, the wheat crop of Minnesota was trifling, and the value of the wheat raised there was as yet one of nature's undiscovered secrets. How the shrewd and far-seeing German miller was able at long distance to hit the mark exactly, while the best American authorities, with every facility for ascertaining the facts, went so far wide of the truth in estimating the possibilities of the west, is beyond conjecture; yet he actually

did it, and his prophecy was not a mere chance shot, but the result of serious and careful study of conditions, and he had sufficient confidence in it to warrant him in urging his son-in-law to act in accordance with it.

Perhaps too much space has been given to the point of view of the wheat authorities of the late '50s, but to those who realize what is now being accomplished in wheat-raising in the then despised west and northwest, such prophecies are both interesting and valuable. At that time wheat culture was midway of the century and really seemed to have paused in its progress. The country was on the eve of a great civil war which was to drain it of its farmers, north and south, for some years; which would scatter and commingle men from various States; change boundaries; alter conditions; open up new avenues of effort, and eventually result in sending towards the west thousands of people who would develop new territories and raise new crops. The authorities quoted were thoughtful men who reasoned logically, from the best information then obtainable. Their forecasts seem absurd now, but they were rational then. These men could not possibly see the immense changes which were about to ensue in the agricultural expansion of their country. At that time, spring-wheat occupied a position analogous to that of macaroni or "goose-wheat" to-day. It was regarded as far inferior to winter-wheat, and hardly worth cultivating. As no one knows the possibilities of macaroni-wheat now, so, at that time, the authorities referred to could not know that a way would be found of grinding spring-wheat which would make it immensely valuable, and enable States wherein it could be grown to

add 300 million bushels to the annual product of the country.

Their prophecies, made in good faith as the result of careful study, merely show how futile conjectures on the possibilities of wheat production are at best. Probably our confident predictions of 1902 will, fifty years hence, seem equally absurd and narrow. In wheat production, nature keeps ahead of man's requirements. A very few years ago, men smiled when the Canadian northwest was spoken of as a possible great wheat country; they, like Klippert, were sure the limit had been reached, and were able to prove it and quote chapter and verse conclusively. These prophets and seers are not in evidence now; the returns of Manitoba, Assiniboia, and Saskatchewan on the last crop make them dumb.

CHAPTER VIII

The wheat-fields of to-day—Agricultural development of the United States since the civil war—The western and northwestern wheat area—Wheat of the Pacific coast—The Oriental trade—American methods of raising wheat—Per capita consumption and exports

WITH the close of the civil war in the United States, the growth of wheat began to assume something like its more recent proportions. Even during this mighty struggle between contending armies, the annual crop was, as compared with that of 1850, very large. In 1862 it was 186 millions, and in 1863 190 millions, nearly double the crop of 1850. This was doubtless due largely to the fact that much of the area sown to wheat was

north of the scene of war, and, although the presence of a large portion of the able-bodied farmers at the front must have handicapped agricultural operations to a large extent, nevertheless large wheat harvests were gathered during the entire war period.

In 1866 a crop of 152 millions was the last which fell below the 200 million mark. From that year until 1874 the annual harvest was between 200 and 280 millions; then it made a record of 309 millions. Four years later it crossed the 400 million mark, and another record was broken; from 1878 to 1882 it was less than 400 millions but once, and nearly every year it greatly exceeded that figure. The line marking a product of half a billion bushels was passed in 1882. By this time the opening of the northwest and the consequent increase of spring-wheat production, due to what is known as "the milling revolution," had been making large additions to the country's wheat supply. In 1884 another high point was reached, the crop being 512 million bushels. Two years, 1885 and 1890, yielded less than the decade's average crop, but in 1891 the harvest reached the unprecedented figure of 611 millions. Seven years later even this was eclipsed by a crop of 675 millions, which in turn was outranked by the yield of 1901, which was 721 million bushels. Whether this record can be equalled or exceeded in the near future is doubtful. The spring-wheat crop of 1901 was 320 million bushels, and competent authorities consider that Minnesota and the Dakotas, the chief spring-wheat States, have almost if not quite reached their limit in this direction, owing, not to climatic or soil conditions, but rather to the fact that flax and stock-raising are

becoming more important and profitable industries in this section. A decided increase in the price of wheat, if maintained for a considerable time, would doubtless stimulate northwestern farmers to increased effort in wheat-raising. Should such a thing occur, they would probably demonstrate that even the last great crop could be exceeded.

After the civil war, the great western immigration movement was renewed in earnest, and enormously increased. Kansas and Nebraska began their true development. Minnesota and the Dakotas were filled with pioneer farmers. California learned in 1852 that gold could be profitably grown from the soil as well as discovered beneath it. Oregon and Washington fell into line as wheat-producing States. The work of the new agricultural sections began to show in the annual crop returns. The story of the discovery of the value of spring-wheat, and its elevation from its former despised position among cereals, has to do with milling, and will be told in another chapter. Beyond the great impetus it gave to wheat cultivation, there were other important factors contributing to the nation's wealth in grain. The vast treeless plains of the west, supposed for a long time to be arid, were found worthy of cultivation. The people of Kansas, Nebraska, and even Minnesota, had their early and desperate struggles with the grasshopper plague, but they found that the pest could be overcome. Kansas, raising nearly as much wheat in 1901 as the entire United States did in 1850, has answered the prophecies of the wise men of fifty years ago, who talked about the "great American desert" and the barrenness of the far west. Minnesota,

with a wheat crop of 88 million bushels in 1901, has replied to the pessimists who a few generations back predicted that her climate and soil were not adapted to wheat-raising. In 1901 27,-800,000 acres of land were devoted to winter-wheat culture and 20,894,000 acres to the growth of spring-wheat—a total area of more than 48 million acres, averaging a yield of 14.8 bushels to the acre.

It should be explained that the wheat of the United States is the *Triticum vulgare*. This is divided into two sub-races, *Triticum hibernum*, winter-wheat, and *Triticum aestivum*, spring-wheat. These are again divided into many groups—bald and bearded, hard and soft, white and red, and subdivided into varieties according to the texture and colour of the kernel, and colour and quality of the straw, and other characteristics. Winter-wheat is sown in the autumn and harvested in the early summer; spring-wheat is planted in the spring and harvested late in the summer and early autumn. It is needless to enumerate the climatic causes which work to the disadvantage of these two great rivals in the wheat kingdom; drought, winter-killing, early frosts, and wet harvests—all have an important influence over the crop returns. Twenty-five States and Territories raise winter-wheat; nineteen produce spring-wheat, some States raise both. The leading crop-producers in the winter-wheat section are Kansas, California, Ohio, Indiana, Illinois, Missouri, Pennsylvania, Oklahoma, Oregon, Michigan, Maryland, and Tennessee. Of the spring-wheat list, Minnesota, North and South Dakota, Nebraska, Washington, Wisconsin, and Iowa are the most important.

Wheat was first grown on the Pacific coast by



An Oregon Elevator. Wheat handled in Sacks.

the mission fathers, and a crude mill was built in 1796. In 1800 a good crop was harvested. Six years later the first export shipment was made, and this went to Siberia. In 1847 Oregon raised 180,000 bushels. From 1847 to 1852 the gold-fever raged, agriculture was neglected, and farms deserted; but after this excitement had somewhat spent itself, men found money in raising wheat, which was at that time almost as valuable as gold. California's crop in 1852 was 272,000 bushels, and seed wheat sold at 12 cents a pound. In 1854 the crop had increased to two million bushels. This was the beginning of mill-building on the coast. In 1856 Oregon was a shipper of wheat to California. In the early '50s an export flour trade was begun with China, Mexico, Central America, the Pacific islands, and Great Britain. In 1867 the exports of coast wheat to Europe grew important. Oregon, and later Washington, began to rival California in the Oriental trade. While wheat from the Pacific coast has always found a ready sale in Europe, the flour from that section has never secured an important and permanent position, the market in Britain for American flour being principally confined to the grades exported from the mills of the central west and east. In 1888 California exported over 34 million bushels of wheat. It is notable that Pacific coast wheat finds but a limited demand in the central and eastern portions of the United States, and a movement of the crop towards Chicago is exceptional. During occasional periods of comparative scarcity, attempts have been made to grind Pacific coast wheat in the great mills of the central west, but these have been unsuccessful, as the wheat does not produce the quality of flour

which the trade of these mills demands and expects.

The great market for the surplus of the Pacific coast is in the Orient, China and Japan being important customers, and to this market the millers of Oregon, California, and Washington are giving their chief attention, as the demand is for flour rather than wheat. Portions of China and Japan produce some wheat, and there are flour-mills there, but should the Asiatics become wheaten-bread eaters to any great extent, the native crops raised would be insufficient to supply their needs, and the Pacific coast millers would naturally expect to control this traffic. The tendency of China towards an increased consumption of flour is shown by the exports of the United States. In 1888 362,000 barrels of flour were shipped to China; in 1890 the exports were nearly 500,000 barrels; four years later the Chinese took over 600,000 barrels; in 1895 over 800,000; from 1896 to 1898 between 900,000 and one million barrels annually, and during the last four years the exports of flour to China have averaged nearly a million and a half barrels per annum. The growth of the American flour trade in Japan has enormously increased. Fourteen years ago it amounted to some 27,000 barrels; in 1891 it was over 75,000 barrels; four years later it reached 93,000 barrels; in 1897 it exceeded 230,000 barrels, and during the last four years it has averaged annually 320,000 barrels.

Both the Japanese and Chinese are ambitious to do their own flour-milling, and thus overcome American competition; but the success of their efforts in this direction is not yet assured. American consuls have periodical attacks of future Japanese and Chinese flour-mill competition, and

frequently dilate on the subject in their reports to the State Department; but the practical American miller, familiar with methods and conditions, is able to see the weak spots in the Asiatic milling proposition, and the spectre of the Chinese miller does not terrify him. Instead, he makes his plans to increase his plant and extend his Asiatic trade further. In 1885 the first modern roller-mill was erected in Japan, an American mill-builder having constructed it by order of the Japanese Government. The mill was mechanically successful, but the native wheat was of such a mixed character that the flour at the best was but a feeble imitation of the American product. The dilatory, easy-going, slipshod methods of the Japanese mill operatives would have produced poor flour even if the wheat had been good.

In a recent American consular report the statement is made that the soil and climate of the northern island of the Japanese group are well adapted to the production of wheat and that "a big flour-making company had recently been started in that part of the empire." The worthy consul explains further that it is now "turning out some 10 million pounds of flour annually, and the company hopes in time to prevent the importation of American flour." The enormous product named is equivalent to the out-turn of an ordinary village mill in Minnesota of 125 barrels daily capacity, and therefore the excellent consul seems to be needlessly excited over Japan's new "big" mill which hopes "to prevent the importation of American flour."

A more formidable competitor is the plant of the Fou-Foong Flour Mills Company at Shanghai. This was built in 1900 by an American mill-building

company for a Chinese corporation; its superintendent is an American, and it has a daily capacity of 300 barrels. While some wheat of an indifferent character is grown in China, the owners of the Shanghai mill expect to be able to make their flour from imported wheat, and should their first mill prove successful, they intend to construct others in different cities throughout the empire. Doubtless Chinese millers would have quite an advantage over their American competitors in knowledge of the customs, habits, and prejudices of the people, but it is doubtful if a 300-barrel mill in China could produce flour as cheap as a mill ten times its size in California. It is true that, everything else being equal, a mill which depends for its raw material on a crop grown out of the country and imported, is at a great disadvantage compared with the mill situated at or near the base of supplies. This has been practically demonstrated so often that it has become almost a milling axiom, the few exceptions merely proving the rule.

The erection of a few Chinese and Japanese flour-mills are rather an indication of the permanency and increase of wheat flour as a food among the Asiatics, than a serious menace to American competition. The exports of flour to China and Japan are not in themselves very important; but if they are significant of a change in the food of the people they are full of meaning. Mr. James J. Hill, the great northwestern railway owner and operator, whose wonderful foresight in industrial development has been demonstrated by practical results, and who has backed his judgment with the successful investment of enormous sums of money, believes that in the Orient will be

found a very large market for American flour, and that its development is merely a matter of time. In his scheme of railway and steamship building he evidently has this traffic in mind, and he has said that 500 millions of people in China will, he believes, become wheaten-bread eaters.

Singularly enough, the Pacific coast miller is sceptical as to the possibilities of the Oriental flour trade, or he affects scepticism of it in his public utterances on the subject. This despite the extraordinary growth of the Chinese export flour trade. It is possible that he assumes this position in order to quiet the ambitions of his competitor in the northwestern States, who is ever alert to discover new markets for his flour. Thus far the Pacific coast miller has had the control of the American flour trade in China and Japan, but he has not shown the same zeal and enterprise in exploiting it as the northwestern millers displayed in building up their European business. Should recent attempts at forming a trust of the Pacific coast mills succeed, the millers in the Mississippi valley will undoubtedly take a hand in the Oriental trade. Nothing builds up an export trade like keen competition. It may be hard upon the individual, but it is beneficial to the nation as a whole. Attrition in prices stimulates and extends a demand and forces a market where none existed before.

In this instance the great transcontinental railway lines controlled by Mr. Hill and his associates, and connected with steamship lines similarly controlled, will have every incentive to encourage, by exceedingly low rates of freight, the hauling of the flour for the Asiatic market from the middle west. At present these railway lines

gain but little by the existence of the Chinese flour market. If the freight originated in the northwest, they would not only get the long haul across the continent by rail, but would thereby secure cargoes for the immense ships which Mr. Hill is building for the Oriental trade. He himself has said that, given the demand in one place and the supply in another, the carrier can and must make a rate of freight which will move the commodity, and, providing the traffic is great enough, this rate can be reduced below any figures to-day existing. If Asia indeed be a developing flour market—if her people are becoming bread-eaters—their demands will be enormous. The supply to meet it will be found in the northern part of the Mississippi valley, and Mr. Hill is evidently preparing to furnish the connecting link. To many observers of this interesting situation, the position of the Pacific coast millers in regard to the Oriental flour market is similar to that of the Atlantic coast millers when the European export flour trade was created. Previous to this time, the millers of the Atlantic coast had done some exporting, but it was only when the large mills of the middle west, forced to find a market abroad for their flour, entered the field that the traffic began to expand in earnest, and the present very important European export trade was established.

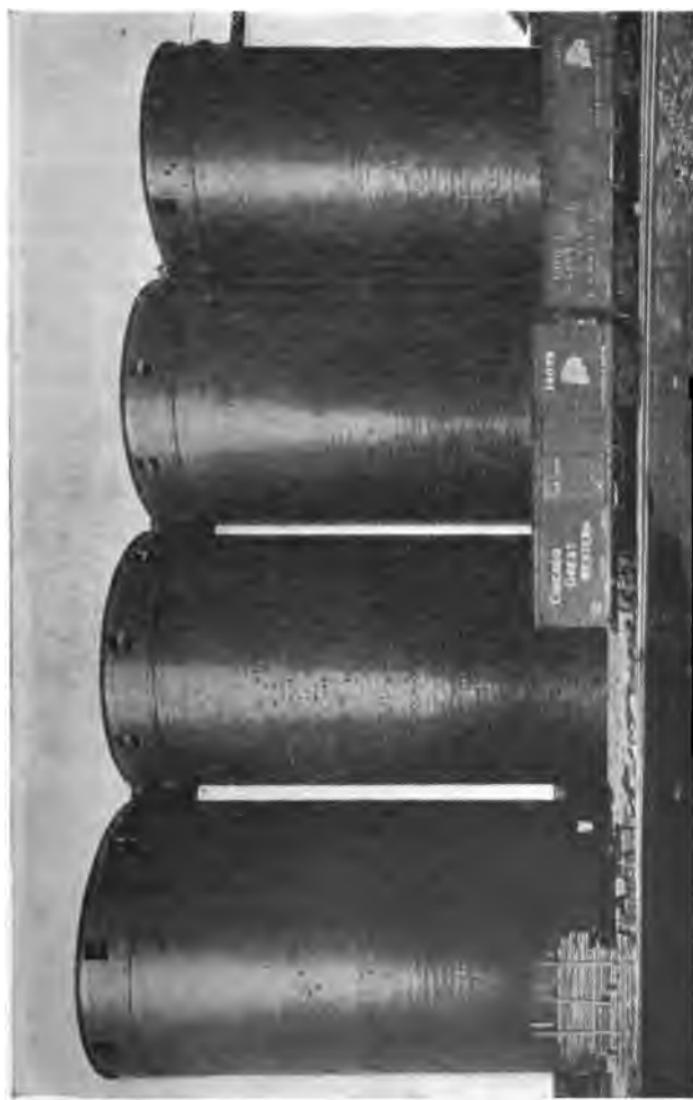
The beginning of the twentieth century finds the United States far in the lead as a producer of wheat and flour. Its farming methods are the most advanced and approved, and the man behind the machine is the most intelligent wheat-raiser in the world; his Canadian brother is his only equal; both read and think. The excellent agri-

cultural colleges established, with the assistance of the national Government, in various States are doing magnificent work in keeping up the standards of wheat culture; in experimenting with new varieties, and determining their value as to quality and yield; in educating the rising generation of farmers to cultivate the soil scientifically and successfully; in teaching young women to become proficient housekeepers, and fitting them for their work in life as farmers' wives and daughters. The American farming implements are models for the rest of the world, and can be seen in the wheat-fields of every land where wheat is successfully grown.

The American elevator systems, whereby the product of the wheat-fields is cared for until required by the world for grinding, are elaborate and cover every section in which wheat is grown. Terminal elevators of enormous capacity are situated in the great centres of distribution and points of export. These elevators are of distinctively American construction, economical in cost, yet models for effectiveness and utility. They mark a complete departure from European methods of elevator-building and are the result of practical experience in the handling and storage of wheat. The wooden structures once used for this purpose are being rapidly replaced by elevators of steel, concrete, or tile, which being fire-proof accomplish a large saving in insurance.

The modern mills of the United States will be described in another chapter, and the subject of transportation will also be reserved for subsequent and separate consideration. In brief, the flour-mills of this nation in size and equipment are unrivalled, and the rail transportation facil-

Fire-proof Tile Grain Tanks, America.



ties, in extent, in cheapness, and in the completeness with which they cover the wheat-growing sections, are incomparably the best in the world. In the United States, therefore, at the present time, King Wheat thrives under favouring conditions such as he has known in no other land. From planting to harvesting ; from the field to the elevator ; from store-house to mill, and from mill to market—the wheat berry is given every advantage that the skill, knowledge, and experience of man can devise ; all moving in a systematic, co-ordinate scheme, the intent and object of which is to give the masses of the world the very best possible food at the very lowest possible cost.

Under such conditions, let us consider what this favoured nation does for itself and the world at large in the way of wheat supplies. As already stated, the wheat crop of the United States in 1901 was 721 million bushels. The per capita consumption is estimated at 4.53 bushels. The exports of wheat for the twelve months ending June, 1902, were nearly 155 million bushels ; the exports of flour nearly 18 million barrels. The principal countries which took wheat from the United States, in their order as to quantity, were the United Kingdom, Germany, British North America, Africa, and France. The principal buyers of flour were the United Kingdom, Holland, Germany, China, Cuba and the West Indies, Brazil, Japan, and Africa. The total value of the exports of wheat and flour exceeded \$178,000,000. Previous to 1872, the largest crop of wheat raised in the United States did not equal the amount exported thirty years later.

CHAPTER IX

The wheat-fields of to-morrow—The Canadian north-west and its amazing crops—The effect of opening the new fields—Political and industrial changes resulting therefrom in Canada and the United States—The beginning of the end of ultra-protection—The future wheat-growing possibilities of the new northwest—Birth of a new producing nation

In the territory belonging to the United States lie the world's greatest wheat-fields of the present day; but the demands of the world's stomach are appalling in the matter of bread, and in order that they may be supplied and that none of the earth's inhabitants need go hungry, King Wheat must ever be extending his dominion and finding new lands to conquer. Just as the wise men of the old world had made up their minds that the limit of wheat-raising on the western continent, which they had been continually croaking about for half a century, had at last actually been reached; that thenceforth the agriculturist would mark time in the growing of wheat and the consumer be obliged to look about him for a substitute for his favourite food, there occurred a development and expansion in the wheat-producing area, which was so surprising and unexpected that it not only upset all calculations of the prophets, but exceeded the expectations of those most directly concerned, the people on the spot who were engaged in wheat-raising. This astonishing phenomenon opened to the view possibilities which are as yet only partially comprehended, even by the specialists, and affords at least reasonable

hypothesis for the belief that the supremacy of the United States as the world's granary will in the near future be overthrown, and that to western Canada will belong the honour of being the chief province of the King of Cereals.

Eastern Canada had raised wheat crops of more or less importance for many years, but neither the total amount produced, the yield per acre, nor the quality of the berry was such as to disturb the equilibrium of the world's markets. Canada was conservative in the growth of her agriculture, her immigrants being largely of a class different from that of the American northwest, which did not take kindly to the drudgery of raising wheat in a new and thinly settled country. Ontario and Manitoba were the chief wheat provinces. In the former, winter and spring wheat were raised; in the latter, spring-wheat exclusively. In 1896 Canada's wheat crop was about 36 million bushels; the three following years it averaged less than 60 million bushels, while in 1900 it was but 40 millions. Suddenly, in 1901, it rose to more than 84 million bushels, and as over 63 millions of this quantity were the product of Manitoba and the Northwest Territories, the world was startled into realizing that a new and great wheat-field had come into existence.

The wheat crop of western Canada for 1901 was phenomenal. The highest number of acres heretofore cropped had been something over sixteen hundred thousand in 1899, but in July, 1901, it was known that over two million acres were under cultivation and that the prospects for a great yield were most promising. The autumnal crop in its realization exceeded the estimates of

the most optimistic, both in yield and quality. Western Canada produced from a little over $2\frac{1}{2}$ million acres a wheat crop of 63,425,000 bushels, or an average yield of 25 bushels to the acre—the greatest ever grown on unfertilized land in the world's history. Not only was the yield enormous, but the quality of the wheat produced was superb. It was the ideal spring-wheat of the variety prized by flour-makers the world over for its superior strength; of great value for blending with wheat of lower grades in order to produce a desirable milling mixture.

When the truth regarding this achievement became known, it created a profound sensation among those who were concerned in the problem of the world's food supply. It was not that the crop in itself was so enormous, for Minnesota alone raised 88 million bushels that year, and the crop of North Dakota exceeded that of western Canada by 13 million bushels. The significance of the returns was in the phenomenal yield. This, taken in connection with the fact, which was known, that only a trifle of the cultivatable land of western Canada had been tilled, made it apparent that, if this great area was to be opened up to wheat culture and would yield even approximately what it produced in 1901, the spring-wheat States on the American side of the line might well look to their laurels.

The inhabitants of North and South Dakota and Minnesota were not unmindful of the ability of their Canadian neighbours to rival them in the quality and yield of their fields. For ten years the average yield of Manitoba had been nearly twenty bushels to the acre. Even in 1900, when in many portions of the United States the crop

was a failure, Manitoba averaged ten bushels to the acre. In 1899 and 1900 some of the shrewder and more far-seeing of the American farmers in Minnesota and the Dakotas had quietly crossed the line and bought farms in Manitoba. But, although something was known of western Canada's possibilities, the Americans counted upon the traditional conservatism of the farmers of the Dominion, and were totally unprepared for the practical demonstration made by the crop of 1901.

A glance at the map of western Canada will give some idea of the tremendous area comprised in Manitoba, Assiniboia, Saskatchewan, and Alberta. This vast empire lies north and west of those northwestern American States which are world famous for the quality and extent of their wheat crops. A thousand or twelve hundred miles north of the American boundary, in the Peace River valley, wheat of superior quality is grown. How much farther north and west it may be successfully cultivated is still to be accurately determined by practical experiment. The State of North Dakota, its sister State of South Dakota, and its great wheat-producing neighbour, Minnesota, might all be easily placed, without crowding, within the limits of Saskatchewan, Assiniboia, and part of Alberta. This would still leave Manitoba out of the calculation. It is estimated that Manitoba has 25 million acres of land suitable for cultivation; less than one-eighth of it is now being tilled. The total area of this province equals that of England and Scotland combined. In 1901 Assiniboia planted less than 400,000 acres in wheat, and reaped a harvest of 10 million bushels, averaging 26 bushels to the acre. Saskatchewan, still far-

ther north, raised more than 800,000 bushels from only 37,000 acres, averaging about 26 bushels. Alberta, stretching westward from these territories, put only 40,000 acres in wheat, and in return gathered a crop of 980,000 bushels. In portions of Assiniboia phenomenal yields were grown; many farmers, it was reported, made 49, 52, 53,



An American Elevator Town.

and one 60 bushels to the acre. It was the contemplation of such returns as these and the enormous area still to be developed, rather than the crop itself, which startled the farmers, millers, elevator-owners, wheat-dealers, and flour-sellers in the United States and abroad.

By many the Canadian crop of 1901 was regarded as exceptional, and these expressed the belief that "one swallow did not make a summer," and that the excitement of the wheat-growing possibilities of the Canadian northwest was a mere "boom" not likely to be permanent. This opinion was not shared by those who had travelled

through the territory and were familiar with its soil and climatic conditions. Further, the wheat crop of 1902 demonstrated that the former year's success was not sporadic. Manitoba's crop again broke the record, being 53 million bushels, with a yield of 26 bushels to the acre. The Northwest Territory, including Assiniboina, Saskatchewan, and Alberta, produced nearly 15 million bushels, with a yield about the same as the year before. With these results before them the doubting Thomases of the wheat trade are left dazed and amazed at the magnitude of the new dominions which King Wheat is conquering, and the consumers of bread are reassured as to the future of their supplies.

Remarkable effects are following the discovery and development of this new wheat country; so far-reaching are they that it is impossible to estimate their ultimate influence. The average yield of wheat in the United States, it will be remembered, was only 14.8 bushels in 1901; in 1902 it was 14.4 bushels. Comparison with the yield in western Canada set the farmer in the United States thinking, and his thoughts logically moved him to act. In many western States the yield was even less than the average. Land had become expensive in America, and it was cheap in western Canada. The enterprising agriculturist in the United States was not slow to see his opportunity.

Farmers in such States as Missouri, Iowa, and Illinois, comparatively remote from the new fields, have bought land in western Canada. In increasing numbers the shrewd wheat-growers of Minnesota and the Dakotas have crossed the border and purchased farms in the Dominion. In 1900 and 1901 the country banks of the middle western and

northwestern States were full of money—the deposits of prosperous farmers who had realized good profits from the sale of their crops. These banks actually found it difficult to loan their surplus funds. Farmers had paid off their mortgages and were depositors, not borrowers. Country banks, in turn, heaped up balances in the local money centres, such as Minneapolis and Kansas City. The banks of these cities were obliged to go east and even abroad in order to loan their money to advantage. Bonds of foreign countries were common investments in these institutions, which but a few years previous were obliged to borrow millions of dollars from eastern and Canadian banks in order to finance the northwestern crops. With the opening of the new fields to the north the western farmers withdrew their balances from their local banks and even borrowed money with which to purchase farms in western Canada. Land companies were formed in the United States which bought hundreds of thousands of acres in Saskatchewan and Assiniboa. These were surveyed, divided, exploited, and sold to agriculturists seeking new homes across the border. Groups of neighbours in the States moved together in the purchase of Canadian lands, and the younger farmers went north to develop them. The immediate result of this movement was a very large reduction in the cash balances of country banks, a tightening of the local money markets, and a consequent effect upon banks in the larger western cities. These in turn called in their eastern loans, and this doubtless contributed materially to the somewhat marked stringency in the money markets of the eastern American cities, which ruled during the latter part of 1902.

How much further this may be felt is still to be learned.

Immigration is pouring into western Canada as a result of its phenomenal wheat crops of 1901-'02. The official figures issued by the Dominion Government show that, in 1901, 37,595 immigrants registered in Winnipeg. For the ten months ending October, 1902, 64,075 arrivals registered there. It is estimated that during 1902 fully 100,000 immigrants arrived in the Canadian northwest to become permanent residents. The registration figures quoted do not show the total arrivals. At least 25 per cent of the immigrants were of the independent class, and not requiring either assistance or advice from the department did not register. Of the 64,000 who registered, 24,000 were from the United States. The value of the effects imported by the settlers gives a clearer idea of the extent to which the farmers of the United States are turning northward in search of new fields. In 1902 the total valuation of these effects were \$4,580,000, of which \$3,751,000 were imported by settlers from the United States, and but \$802,000 by those from Great Britain. The homestead entries in western Canada during the fiscal year ending June 30, 1896, were but 1,857; for the same period in 1902 they were 14,832. This indicates what wheat will do in the opening up and development of a new country.

The financial effect of the discovery of new wheat lands, in withdrawing capital from one country and investing it in another, is but one of the many interesting phenomena connected with this new and very important development. If the exodus of American farmers continues, and it probably will, more lasting and important po-

litical and industrial results will follow. Both Canada and the United States are at present enjoying the doubtful blessings of a protective tariff. Without entering in detail into the vexed question of the tariff relations between these neighbouring



A Steel Tank Elevator, America.

countries, which is a long story, its history, in brief, is a game of political see-saw. They have never been able to come together on a mutually satisfactory tariff. When the United States is up in the air on a high-tariff policy, Canada is usually down near the ground with a moderate policy. Should the United States incline towards a tariff-for-revenue-only basis, Canada is off on a wave of ultra-protection. It is unfortunate that this should be so, because both countries would be benefited by an interchange of commodities on the basis of a moderate tariff. The game of political tag has gone on for many years, but is ap-

parently no nearer conclusion now than when it began. It is due to the Dominion to say that it has earnestly tried to secure reciprocal trade relations with the United States in the past, but when its commissioners arrived in Washington seeking to promote fairer trade relations, the dominant party in the United States was committed to a policy of ultra-protection and the Canadian overtures were politely but firmly rejected. The increased tariff against the United States, which followed these fruitless efforts, was in the nature of retaliation, and since all attempts at securing a reduction of the tariff on Canadian goods had failed, the Dominion was scarcely to be blamed for turning away from her unresponsive neighbour and seeking favourable trade connections elsewhere.

The development of western Canada, the movement of farmers from the United States to the newly opened wheat-fields, and the large investments of American capital in the Dominion, are creating a change in sentiment on the tariff question which will doubtless have a pronounced effect upon the future political course of both countries. The natural channel along which trade relations should develop runs north and south. Western Canada, were it not for the tariff barrier built between the two countries, would find a ready market close at hand for her agricultural products. Lines of communication exist from Manitoba and the Northwest Territories to Minneapolis, which, with its innumerable outlets by lake and rail to the south and east, created in response to the wonderful growth of the American northwest, is in reality the gateway to the markets of the world. If Canadian wheat and flour and other

products were permitted access to the United States free of tariff, they would find an immediate and profitable primary market, and they would also secure advantage of the railway systems already in existence which are now taking the products of the northwest to the Atlantic seaboard, and thence, with the choice of many ports, to the old world, at the lowest possible rate of freight. Instead of enjoying these facilities, ready at hand, the products of western Canada are forced to find an outlet to the world over practically one railroad, which enjoys a monopoly of entry into the new fields, and, in the summer season, by the Great Lakes, keeping within Canadian waters and using only Canadian ports. These facilities are utterly inadequate to handle such crops as those raised in 1901-'02, and consequently there has existed congestion and delay in moving the wheat, the resultant expense necessarily coming out of the wheat-growers' pockets in the end.

A duty of twenty-five cents a bushel on wheat prohibits the entry of any portion of the Canadian crop into the United States, and shuts out the Dominion farmer from participation in the benefits enjoyed by the agriculturist across the border. Even if this duty were removed, it is questionable if the dominant railway would permit any large movement of the crop towards the south, because it desires to secure the "long haul" eastward from the wheat-fields to the Canadian seaboard over its own road-bed, thereby obtaining for itself the entire revenue in freight which the crop affords. Eastern Canada would support the railway in this endeavour because it would naturally prefer to control the traffic and keep it within Canadian channels until it went abroad. Eastern Canada and the

existing railway monopoly would therefore resent a movement towards reciprocal trade relations, the result of which would be to divert any portion of the grain wealth of the new northwest towards the United States. Hence, so far as these interests are concerned—and they are now able to control the policy of the Government—Canada is further from lowering the existing tariff-wall than she has been for many years. On the other hand, northwest Canada, growing enormous crops and anxious to secure easy and cheap ways to market, looks longingly across the line and frets at the tariff barrier built by political hands which shuts her out from the promised land. This smouldering sentiment may be fanned into a future flame by the large number of American farmers who are settling in the Canadian west. These are not accustomed to having their crops at the mercy of one railroad. The country they removed from is gridironed with rails, and although recent combinations and mergers have somewhat reduced and regulated competition, still the rate of freight from the wheat-field to the market is exceedingly low and there exists no lack of facilities with which to handle the crop when it is harvested; indeed the American farmer is exceptionally favoured in this regard. These settlers will soon insist on a change in tariffs and traffic arrangements, and will clamour for access to the market which is in geographical propinquity to them regardless of political walls. The influence of the Canadian northwest upon the future tariff policy of the Dominion is a factor which within a few years must be reckoned with. It will be strange, also, if the settlement of this new land by so large a number of farmers from the United States,

schooled in republican principles and entirely out of sympathy with British traditions and institutions, does not have a tendency to undermine, or at least relax, that spirit of loyalty to England which has hitherto characterized the Dominion. This, however, is a speculation in the domain of higher politics which is rather beside the question. It is true that western Canada as a whole looks favourably towards closer commercial, if not political, relations with the United States, although, the country being so newly settled, such a sentiment has not as yet had time to crystallize into formulated expression.

There can be no question as to the effect the opening of this new and fertile section has had upon tariff sentiment in the United States, and particularly in the northwestern section thereof. For some years the people of the middle west have, unknown to the politicians, been changing their opinion as to the sacredness of the protection idol. Coming mainly from the east, they brought with them their ingrained and inherited belief that the greatness of the nation was due very largely to the policy of high protection. For years they have been stanch protectionists, but gradually at first, and latterly very rapidly, their convictions have been changing. The people of this section have been obliged in a very large degree to seek foreign markets for their products, and in so doing have found the extension of their trade handicapped by the prejudice against the United States caused by its high protective policy. In many instances they have suffered vicarious atonement for the greed of others, and, in return for the protection given favoured eastern industries, they have been punished by

having their products barred out of certain foreign countries by the imposition of retaliatory tariffs. Agriculturists have become restive under a policy which compels them to pay a protected price to fostered "infant industries" for articles they wear or use, and affords them no assistance in selling their products abroad. Western manufacturers seeking foreign markets find no help in the national protective policy. The growth of the trust and its increasing power is commonly believed to be the result of ultra-protection, and the western consumer is convinced that the abolition of the tariff on trust-controlled commodities would relieve the country of the pinch of monopolies which is increasingly felt.

"Lower the tariff" has been the whisper of the central west for some years; latterly it is growing into a clamour, but still the sound of it has not reached Washington. The mildest form taken by this spreading conviction is a belief in reciprocity, and the feeling in its favour is practically unanimous in the middle west. Still, Washington ignores the rising storm, and all attempts to negotiate reciprocal treaties with foreign countries have failed. This simply intensifies the increasing dissatisfaction with the existing tariff. In no other section of the United States was the last speech of President McKinley, with its strong fair-trade sentiment, received with such genuine satisfaction as in the middle west and northwest. The wise suggestions therein contained have been ignored by the dominant party, however, and no move has been made either towards a modification of the tariff or the arrangement of reciprocal trade relations. With the advent of western Canada as a great wheat-producer, the northwest realized

that the existence of the tariff wall between the two countries threatened the loss of a great opportunity for commercial expansion, and became more insistent than before for the abolition of the absurd and unnecessary barrier which keeps two natural customers apart.

It is true that the duty of twenty-five cents a bushel prevents Canadian wheat from crossing the line and therefore theoretically protects the American farmer. Some years ago he would have



Terminal Elevators, America.

believed that it actually protected him, but he has grown sceptical of the tariff idol and is inclined to examine him more closely under the impression that he is stuffed with straw. The American farmer is no longer an unlettered rustic who follows his crop only as far as the nearest railway station. He has discovered that a tariff which keeps Canadian wheat out of the United States, but is powerless to keep it out of Liverpool, is no protection whatever. He has learned that Britain makes the price of his wheat. If,

therefore, the Canadian crop reaches the foreign market through Canadian channels, and not by way of the United States, it depreciates the value of American wheat quite as much or more than it would if it came into direct contact with the wheat of the United States. The farmer knows further that the wheat grown in the Canadian northwest has certain attributes lacking in his own grain. If this wheat be received freely in the United States, and ground by the mills into flour, the farmer is aware that these attributes will blend perfectly with those of his own wheat, and therefore that the Canadian product thus handled will assist in marketing his own abroad. Examined thus closely, the twenty-five cent duty on wheat which was created in order to make the farmer think he was being protected, becomes a mere farce. Instead of a benefit it is actually a detriment to his development and prosperity.

The spring-wheat miller would naturally welcome Canadian wheat if he could obtain it free of duty. The quality of wheat produced in the newly settled country is just what he needs and wants to strengthen and improve his flour. Gradually, as the northwestern States have become cultivated, the original hard wheat has grown scarcer. Wheat raised on virgin lands has a peculiar strength lacking in that produced in older fields. It is capable of improving the character of other wheats blended with it when the mixture is made into flour. These mills have the capacity to grind the Canadian crop, and could greatly increase their export trade if they could secure a share of it. Without it, they feel that their future is limited, particularly if the wheat of western Canada finds its way unground to mills in the

United Kingdom. The elevator, banking, grain-buying, exporting, indeed all the commercial interests of the American northwest would be benefited by the receipt of a portion of the great Canadian crops, but a duty of twenty-five cents a bushel kills all hope of obtaining it. Reciprocity, low tariff, and, indeed, absolute free trade, are principles which, in view of this escaping opportunity, are growing in popularity throughout the northwestern portion of the United States at a rate of which eastern statesmen have no conception, and even western politicians but dimly comprehend.

On both sides of the line which divides northwestern Canada from the northwestern States, the discovery and exploitation of the new fields of wheat are rapidly changing men's minds politically, and drawn by their mutual needs, the farmer on one side and the buyer on the other are getting beyond the control of party leadership and are seeking to change the tariff of their respective countries. It is doubtful if any legislation can be effected either in Canada or the United States which will satisfy the demands of these elements, and still leave otherwise intact the tariff structure. If free wheat is obtained, a complete revision of the tariff will probably accompany it. Such a result may indeed follow the present agitation, and if it should, the credit for the removal or lowering of the tariff walls must be given to King Wheat, who has always been an enemy to all human laws which are designed to keep mankind from securing its full and free supply of bread.

Industrially, the development of the new wheat-fields will have a marked effect upon at least three

countries. The tariff will influence this materially. If it is to stand, American manufacturers of farming machinery and implements will build plants in Canada. This they will be obliged to do in order to avoid paying the Canadian duty on their products if shipped from the United States. Many of them have already adopted this policy. The amount of railway building in Canada must necessarily be great in order to cover the vast territory being opened up to cultivation. The lake route will need more vessels to carry the wheat eastward. Elevators and store-houses must be erected to handle the crop, and a great impetus will be given to the building of flour-mills in Canada. Should this wheat find no outlet through the United States, because of the duty, then vast quantities must necessarily go abroad to be ground, into the markets of Great Britain and the Continent, for the milling capacity of Canada is not large enough to absorb the crop. Exported as wheat and not flour, the crop of the Canadian northwest will prove a boon to the flour-mills of the United Kingdom. For many years these have been harassed by the competition of American millers; but if they are able in the future to secure sufficient quantities of cheap Canadian wheat, they can produce a flour which for price and quality can defy transatlantic competition, and a revival of British flour-milling, which has not been a flourishing industry for some twenty years, will doubtless follow; with a corresponding decline in the American export flour trade.

The Canadians themselves are exceedingly sanguine as to the future. In a recent interview a Manitoba official, in speaking of the productive capacity of the Canadian northwest, said he ex-

pected that, within the next ten years, 10 million acres in Manitoba would be under cultivation. Assuming a similar increase of acreage in the territories, he estimated that a decade hence northwestern Canada would produce 350 million bushels of wheat. This estimate was on a basis of only a little over 20 million of the 75 million acres which it is claimed are susceptible of cultivation. He believed that, when the full possibilities of this vast area are achieved, the production of wheat will exceed a billion bushels. This would be one-third larger than the greatest crop ever raised in the United States. Americans regard these prophecies as absurd exaggerations, and even some conservative millers in the Canadian northwest, who are in a position to make careful and practical estimates of the future yield of the fields upon which they must depend for their supply of raw material, smile when such figures are mentioned. They contend that a very large portion of the so-called arable land in northwest Canada is utterly unfit for wheat-raising, and is being exploited for speculative purposes. While admitting that this section is capable of growing large crops of excellent wheat, they distrust the official returns and question the accuracy of the reported yields. In their opinion both the railway and the Government officials are inclined to exaggerate and overstate the facts in order to stimulate emigration and the investment of capital. In the matter of inducing immigrants, by jugglery of figures, to purchase and settle upon newly opened lands, the Canadians are no better than their cousins across the border. Indeed in the business of importing and fleecing that perennial victim, the British younger son, who has a small capital to in-

vest in wheat-farming and is looking for an opportunity, the Canadians far surpass the Americans. They have superior advantages in this industry because they understand the conditions in England better, and can more easily secure the confidence of the investor, being related to him by the ties of a common country. In the end the victim perishes the same whether he takes his patrimony north or south of the boundary line. Doubtless, as is common in newly discovered lands, there is more or less trickery and exaggeration in the returns published, and the great danger from early frosts—the result of which is to make the wheat touched absolutely worthless for milling purposes—is carefully suppressed; but taking all this into consideration, beyond all doubt vast crops of wheat, sufficient to contribute materially towards the prevention of scarcity, are going to be reaped in this new and hitherto undeveloped section of the world.

A discovery of a new wheat-producing area, such as northwestern Canada, is really more important to the world than the discovery of gold. A few of the possible results have been suggested in this chapter, but they are merely fragmentary. A new nation is coming into existence, and its object will be to feed older countries which are no longer self-supporting. In what measure it will succeed; how great a factor Manitoba and the Northwest Territories are to become in the world's food supply, can only be surmised. The pioneer farmers will have their difficulties to overcome as the farmers of Minnesota and the Dakotas had—there is the danger of early frosts to which they are exceptionally exposed and which has affected their last crop to a considerable degree—but when

all is said and due allowance is made for dangers and exaggerations, there is warrant for believing that the great wheat-fields of to-morrow lie in Manitoba and the Northwest Territories, and that once again Nature has postponed indefinitely that evil day when man will be able to see the limit to the growth of wheat.

CHAPTER X

The milling of wheat—Earliest methods—The saddle-stone, the mortar, and the quern—The feudal law of milling soke—Slave and cattle power—Water-mills and wind-mills—The use of steam power—Milling processes in 1799

To properly tell the story of milling, its development from the rude processes of ancient times to its present fine mechanical perfection, its growth from the primitive mill of the middle ages to the modern roller-mill capable of producing in a single day enough flour to feed a small city for an entire year, would require volumes. It has a history full of incident; it has its own romance and its own tragedy; its course has affected the policy of nations; it has had a bearing upon important political events, and great industrial battles have been and still are being fought by those engaged in it. Its achievements are the story of man's endeavour towards industrial perfection, the production of the most and best at the least cost. Its discoveries have led to the extension of civilization into new regions and the utilization of certain of the earth's products at one time supposed to be comparatively

valueless. It has served the painter, the songwriter, and the poet. It has furnished a background for the maker of fiction, and it has a very

respectable, if fragmentary, literature of its own. Since it became a distinct trade the making of flour has always been esteemed an honourable occupation, and the miller has occupied an unique position in history because of his traditional sturdiness and independence of character. A favourite theme with writers of all ages has been the miller and his mill, and it



is still deservedly popular, although the mill is no longer picturesque, and the miller, from being a mere rustic whose stout maintenance of his rights and more than average intelligence lifted him above the farmers whose grist he ground, has become a great merchant and man of affairs.

While it would be impossible to narrate the history of this noble and important industry within the limits of this work, it would be equally impossible to tell the story of a grain of wheat without devoting some part of it to milling, for were it not for the work of the

miller, that of the wheat-raiser would be useless. The ultimate value of a crop lies in the worth of the wheat to the miller when he has transformed it into flour. This is a simple and self-evident proposition, it would seem, and yet it is one which many ambitious speculators have overlooked in their efforts to put the price of wheat beyond its legitimate value, and have later discovered to be the true cause of their undoing. Since this is true, it is necessary, in order to understand rightly the story of wheat, to have some understanding of the story of milling, and in this chapter and the next the principal points in the history of its growth will be briefly stated.

Primeval man reduced grain to flour by means of a hand-stone. For four thousand years this was the only form of mill in use. The grain was placed in a hollow stone and pounded into meal by means of a stone-crusher. Aboriginals in all countries used this simple process of milling. In the prehistoric Swiss lake dwellings crushers were in ordinary use. The first grinding-mill was the saddle-stone. This marked the initial stage in the development of milling processes. It has been used throughout the world. The Greeks and Romans knew it, and it is still in use. The upper surface of the stone was made concave; in this hollow the grain was rubbed or ground by means of another stone. This was worked forward and backward; not rolled. Large numbers of these ancient saddle-stones have been discovered, and bear witness to the use to which they were put. The millers of Babylon, Nineveh, Assyria, and Egypt used this process. The method of grinding used by the native Africans of to-day is the same as that in use in the time of Abraham.

The relics discovered in recent times in the ruins of ancient cities show with great fidelity to detail the exact process. A statuette of painted wood found near the pyramids at Dashur on the Nile not far from Gizeh is that of a woman kneeling and grinding grain by means of the saddle-stone. Two limestone statuettes from the tombs near the pyramids of Saggarat show women engaged in grinding by the same method and in the same posture. Both of these are of date about 2200 B. C. Six hundred years later, when Joseph became Pharaoh's administrator of grain supplies, the chief baker was imprisoned and subsequently hanged for producing bad flour. His grinding was done on the saddle-stone. The Hebrews probably used the same appliance after they came out of Egypt, and, as with the Egyptians and Chaldeans, their women and servants did the grinding. The saddle-stone endured through the civilization of Greece and Rome, and the prehistoric remains of almost every race in Europe abound with proofs of the fact that they used it. Across the Atlantic, the aboriginal inhabitants were saddle-stone millers, as their relics attest, and strangely enough, their mills were greatly superior in structure, detail, and finish to any saddle-stone of Europe at even its best period. Thus the Americans in prehistoric days seem to have led their transatlantic contemporaries in the art of flour-making, as they unquestionably do in many respects to-day.

In some countries the mortar was a contemporary and ultimately a successor of the saddle-stone. The mortar was portable, but its great distinction was in being fashioned both inside and outside. This marked the step from barbarism to

civilization. In the mortar period, the Greeks made the first recorded milling revolution in substituting men for women as flour-makers. The operatives were termed "pounders." The Romans subsequently adopted this word, translating it to "pistores." The term survived in Eng-



land and elsewhere long after millers ceased to make flour by pounding the grain. Two centuries before the birth of Christ milling was still drudgery and very often performed by slaves or criminals. The mill and the bakery were combined among the Romans and termed the "pistrinum." Servants and slaves were punished by being obliged to do the grinding. State mills were established among both Greeks and Romans, and criminals were sentenced to labour in them. The work of making and baking flour had been one business from the time of the hand-stone until the mortar period. Indeed, it was really a part of the domestic machinery of each household, rather than a distinct industry. Pliny says there were no bakers in Rome until the war with Perseus of Macedonia, more than five hundred

and eighty years after the building of the city ; the citizens used to bake their own bread, and of course grind their own flour. In 167 B. C., following the defeat of Perseus, a band of captured Greek "pounders" were led into Rome, a part of the triumphal entry of Paulus Æmilius. These craftsmen were set to work at their occupation, grinding and baking, and this was really the foundation of the trade. Not long after Pliny's death the Romans abandoned the mortar for the quern. Less civilized nations continued to use it, and with the saddle-stone it lingered for many years, but was finally discarded by all save the rudest nations of the earth.

The quern, an Italian invention of some two thousand years ago, was the next step in the progress of milling. It was the first complete grinding machine in which the parts were mechanically combined, and succeeded loose stones. The quern introduced a circular motion, the upper stone revolving upon the lower. The saddle-stone was a thrusting machine; the quern a revolving mill. This was the machine in use at the dawn of the Christian era. The familiar quotation, "Two women shall be grinding at the mill; the one shall be taken and the other shall be left," was translated by Wyckliff early in the fourteenth century: "Tweine wymmen schulen ben gryndyng in o querne, oon schal be taken and the tother lefte." The "mola versatilis," as the Romans called the appliance, became known as the quern with the introduction and spread of the mill through Britain, Gaul, and Europe generally by the Romans. The quern of the early period was of one type; the lower stone was conical at first, then flattened; the upper stone fitted its mate and conformed to

its shape; a hollow in the centre, with a hole at the base, served as a hopper for the grain, and in a small hole drilled in the side of the upper stone a handle was inserted. An early but important improvement in the quern was the grooving of the grinding faces of the stone. The edges of the grooves performed the grinding, and their hollows conveyed the meal to the rim of the stones; this was the rude initiation of the right principle of methodical furrowing, not fully developed until the era of water-mills. The quern was the original British flour-mill. In parts of Europe and Asia it is still used, and it is found abundantly in China and Japan. Among the Arabs also the quern is employed. Mr. Richard Bennett, to whose admirable work, the History of Corn Milling, the writer is greatly indebted for much of the information contained in this chapter, found a quern in ordinary daily use at a secluded cottage near Drontheim, Norway, in 1897. This quaint mill stood upon a table three feet high. A square frame inclosed the top of the table and contained a loose circular casing surrounding the stones. The flour was removed from this by sweeping it at intervals to the right-hand corner, where it escaped through a hole and fell into a drawer; altogether a rude but effective grinding machine. A little more than a century ago the quern was in common use in parts of the United Kingdom, but, as Mr. Bennett says: "The march of improvement has rapidly thinned the number of British querns in use, and milled flour from Liverpool or Minneapolis shortly promises to become even less of a curiosity in the retired home of the quern than the old hand-mill itself."

At least something more than passing mention

is due to the ancient and now obsolete quern as a development in milling processes, because of the notable struggle between landlord and tenant, between the public and the lord, which followed the execution of the feudal law of milling soke in England; a characteristic fight of the Briton against oppression. Soke or soc was the monopoly formerly claimed by the mill-owner of grinding all the grain used within the manor or town-

ship in which the mill stood. The quern was the poor man's mill, operated in his own house without toll. The lords of the manor in granting charters to their tenants usually stipulated for a reservation of all milling rights and privileges, compelling tenants to operate the mills they erected, and forbidding the use of querns.

When religious institutions were endowed with gifts of mills—a frequent occurrence—the grants gave the monks the exclusive right to grind grain for the district and prohibited hand-mills. One of the earliest milling documents is a charter given to the monks of Embsay Priory, Yorkshire, in 1150. The rights of the king's mills of Dee, at Chester,



Quern. Isle of Man.

were confirmed by Edward III in 1356, and the use of hand-mills was forbidden. The laws establishing such rights are older than the English statutes. These customs prevailed in a more or less stringent form throughout Europe for many centuries, and were the cause of a determined effort to suppress querns, which lasted seven hundred years, from the eleventh to the eighteenth century. In order to secure an absolute monopoly of the milling business in the district protected by the custom of milling soke, the manorial lords waged a war of extermination against querns. Some were purchased, others stolen, and all thus obtained were destroyed. King, priest, and squire insisted on their rights and searched the cottages for the forbidden machines, dragging them forth from their hiding-places and breaking them up. If the peasant objected, the law was appealed to, and it invariably sustained the strong against the weak.

The history, furnished by the excellent monks themselves, of a prolonged fight over querns at St. Albany's Abbey, Cirencester, is merely an exact and recorded instance of what must have been a somewhat common occurrence in those days. The row began in 1274, and continued for many years. The good abbot, worthy soul, owned milling rights for the entire town, so he ordered the citizens to forfeit to him their treasured querns. He agreed, in consideration, that he would solemnly swear his miller to strict honesty, and, in the event of a dispute, that he would try the case before a court of twelve jurors. For a time this arrangement was maintained, but after patiently playing the abbot's little game for fifty years the townspeople rebelled. They attacked the abbot

and besieged his abbey, successfully obtaining from the good man a charter of liberties—of a sort—although it did not include absolute freedom from compulsory grinding at his mill. They immediately set up their querns again, while the abbot quietly awaited his chance for a return engagement. They were in no hurry in merry England at that time, and the abbot waited six years for his opportunity. When it came he descended in force on the town, searched the houses, cap-



Ancient Swedish Mill.

tured the contraband mills and carried them off to the abbey, where they were used to pave the floor of his private room as an evidence of his prowess. Fifty years rolled by during which the excellent abbot was gathered to his fathers, and his successors walked over the quern-paved floor. In 1381, Wat Tyler having stirred up a rebellion, the slow-moving townsmen bethought them of their time-honoured grudge against the abbey, and again attacked it. They forced admission within its walls, dug up the paved floor, recovered the broken querns and distributed them as

trophies of their victory. In return the abbot made a raid on the town with his bailiffs and carried away the citizens' hand-mills. Then the burgesses made a mistake. If they had patiently waited a matter of fifty years or so they might have caught the abbot napping and have repeated their previous successes, but they were hot and hasty and appealed to the law. This must have caused the jolly priest to shake his plump sides with laughter, for he well knew his legal rights. The result of the lawsuit was that twenty of the townsmen executed a bond in behalf of themselves and fellow-citizens agreeing to pay the abbot a fine of one hundred marks, about \$330, and to grind their grain henceforth at his mill.

The charter granted to Vale Royal Abbey in Cheshire in 1299, gave it the milling rights of the neighbouring town. For thirty years they were duly exercised; but the townsmen then rebelled and arose in arms to prevent the capture of their querns. Then ensued a hopeless struggle, terminated by the submission of the mistaken people. A number of them appeared before the gentle prelate in his monastery with halters around their necks, formally admitting their error. In many of these quarrels the worthy clergy of the time used the spiritual weapon of excommunication to excellent effect. In 1229 the tenants of the admirable prior of Dunstable refused to pay taxes or to grind at the priory mills. They not only withheld taxes and tithes, but they trampled down the prior's grain and told wicked stories about the worthy monks. The clergy retaliated by threatening to excommunicate the rebels. The townspeople weakened at the threat to a degree

and said that they would go to the mill, but rather than pay the taxes, they would take the chances of going to a hotter place. The prior was properly grieved at this impudent answer, and appealed to the chief justice, who threatened the people with the law. This was unavailing, and finally the Bishop of Lincoln was asked to assist the perplexed prior. His grace did so by solemnly excommunicating the whole of the turbulent townsmen, but it was only after pacific arbitration that the long-standing feud was healed. These occurrences show under what circumstances the quern maintained its hold upon popular estimation. It should be noted that the milling soke was not exercised by the millers, but by the landlords who owned the mill.

Various adaptations of hand-mills were used previous to the abolition of soke laws; more machinery of a simple character was added to the quern, but the principle of grinding flour by means of mill-stones continued until very recent years. The greatest changes during the many centuries were made in the motive power rather than in the method of grinding the grain itself. Originally the woman was the universal miller and supplied the power which drove the hand-stone and the saddle-stone herself. Then, as already related, slaves and even criminals did the drudgery of grinding. The mills in operation in Pompeii when it was destroyed in 78 A.D., as shown by the remains discovered in its ruins, were slave-propelled. Cattle mills and slave mills were originally similar; the ass was ordinarily used for mill-driving, and for many years in Rome the human animals and their brute companions performed the flour-making for the Eternal City.

After the abolition of slavery in the fourth century, cattle mills were generally adopted. Treadmills worked by convicts were in use in Europe



Pompeian Mills.

as early as 1537, and are still used in some countries—the sole survivors of the old Roman slave mills.

The slave and cattle mill preceded the water-mill. First the Greeks and then the Romans used water as power for grain-grinding. The early allusions to this, the world's first power mill, occur in the chronicles written from 65 to 85 B.C. In northern and western Europe primitive water-mills have existed beyond all historic records. The Norse mill, as it is usually termed, was established in Britain at an early date. From the

seventh to the eleventh century this type was in use in Ireland. In portions of Scotland the Norse mill is still not uncommon. The mediæval Roman mill was of the vertical type. Records of a water-mill in France exist in a twelfth-century manuscript in the Harleian collection. Prior to the Conquest, England abounded with water-mills; the smaller being of the Norse or Greek type, the larger of the more complete Roman pattern. The Domesday Survey, finished in 1086, gives complete statistics of the mills of England, including their number and location, with particu-



Dutch Wind-mill.

lars of rental, etc. The lists contain the names of numerous places where ancient water-mills still exist, and where milling has been continuously done since the days of the Saxons.

It is not within the scope of this book to give technical details of milling processes; therefore

an account of the improvements made in water-mills from their introduction to the present time is not attempted. The wind-mill came into existence much later than the water-mill. A wind-mill tower of the Crusader period still exists in Syria. The year 1200 seems to be about the date when they were introduced into England, and various styles developed from the original type and came into almost universal use. The picturesque wind-mill of Holland is a good example of the tower wind-mill. In 1784 the Gentlemen's Magazine announced that "A new discovery has lately been made and is now carrying into execution near Blackfriar's Bridge of a method of grinding corn by means of a fire-engine, which communicates a power of working thirty-six pair of stones, besides other subordinate machinery for bolting, etc.; this promises great profit if the inventor can carry it into effect at a moderate expense." The mill thus referred to stood at the Surrey end of Blackfriars Bridge, London, and the engines were two



Welsh Wind-mill.

50-horse-power, made by Boulton & Watt. They worked successfully, and thus the steam-mill at last entered the milling field.

As the changes in flour-making were gradual, so also was the change in the character of the miller himself. When the grinding was purely a domestic occupation, the women of the household was both miller and baker. Then slaves or servants ground and baked. Slowly milling as a distinct trade emerged from its surroundings, and millers ceased to be bakers. Cattle, water, wind, and steam became the grinding power, except in barbaric countries where ancient usage still lingers. The feudal laws held the miller in bondage almost as much as they did his customer, independent mills were few in the middle ages, the lord of the manor owned the mill and his miller was a hireling or merely rented the plant. In time, this system passed away and at last the miller was free—a member of a distinct and separate trade.

At the end of the eighteenth century, both in Europe and America, water and wind mills in large numbers were doing a thriving business. The plant of the time was a structure of few parts and its processes were quite simple. The wheat was cleaned by a machine consisting of a pair of cylinders or screens and a blast of air. The grinding-stones by this time had become flat and round and were scientifically furrowed ; they ran close together in order that, when the wheat passed through them, the greatest amount of flour might be produced. The meal was bolted and the tailings, consisting of bran, middlings, and adherent flour, again sifted and reground. This was essentially the mill-stone process of milling before



Oliver Evans improved upon it, and although it was simple, in spite of its imperfections, the flour it produced was so desirable that, from being an insignificant trade, milling grew to be one of the greatest and most valuable industries of the time. The miller was a rising man, although he was still more allied to the farming than the industrial class, and did not dream of the position in the commercial world he was destined to occupy. Grist-mills were the rule and merchant mills exceptional.

A peculiar fact in connection with the development of milling is that to-day every type of mill known in the history of the trade can still be found in active and practical operation in some quarter of the globe, so that the course of the various processes may be clearly traced by using modern examples. Some Indian tribes in America crush grain in prehistoric fashion; the saddle-stone method, such as was used in the time of Abraham, is still doing duty in parts of Africa; in the Transvaal the pestle and mortar may be seen in common use; the quern may be found still in commission in certain parts of Europe and Asia; the slave mill was but the prototype of the tread-mill; mills driven by cattle are not extraordinary; water-mills, tide-mills, wind-mills, tripod-mills, post-mills, tower-mills; mills operated by steam and electricity; stone-mills and roller-mills—from the beginning to the present, the story of milling progress may be read by the curious in devices and machines still in use and still performing practical work.

CHAPTER XI

Progress of milling—The milling revolution—The purifier and its story—Development of Minneapolis as a milling centre—Direct exports of spring-wheat flour—The mill explosion of 1878—The coming of the roller-mill—The abandonment of mill-stones—The modern flour-mill—Commercial milling—The largest mills in the world—Review of present milling conditions

THE manufacture of flour as it is understood in its largest sense to-day is really a new industry both in America and Europe; for it has been created since the introduction of new process milling which alone made the operation of large flour-mills possible, and this occurred only about thirty years ago. It is such a modern industry that the statistical authorities at Washington are still unable to differentiate between flour and grist mills, and it will take at least another decade for British and American statesmen to understand that the business of flour-making has ceased to be a semi-agricultural occupation and has long become a great commercial industry. The inland and ocean carriers, the legislators, the national authorities, and the general public do not yet understand that the exportation of a country's wheat, instead of its flour, is not an evidence of a nation's welfare, but rather the measure of its lost opportunities and a commercial blunder. The industry as it is to-day is so new that the miller who sold the first spring-wheat flour abroad is still in the prime of life, and other millers who saw the dawn of the new era, as well as milling engineers who installed the first of the modern machines, are still engaged in active business.

The saddle-stone process was that of the individual or household miller; the advent of the quern and its improvements marked the beginning of manorial or village milling; with the mill-stone came the grist-mill, grinding for a larger



Mill-stones grinding.

district and exacting a toll from the farmers who brought grain to it, latterly developing, in a moderate way, into the merchant mill in some favourably located spots in Europe and America. Essentially, the mill-stone era was the grist-mill period. This was swept away almost entirely, except in the more isolated rural districts, by what is called the "revolution in milling," which first brought the purifier into use and soon after substituted chilled iron rolls for the long-used mill-stone, thereby enormously increasing the output

of the plants, creating the modern merchant mill, with its traffic extending to remote markets at home and abroad, and relegating the grist-mill to comparative obscurity and disuse. With this change came the present race of merchant millers, as distinctly different from the typical grist-miller of the mill-stone period as he was from the quern-miller, or as the last named was from the slave miller of Roman days.

For the first seventy years of the last century the development of milling processes, especially in America, was so slow as to be almost imperceptible. In parts of Europe experimental advances were made, but their effect was almost entirely local. Transportation facilities were such that millers would have been unable to go far abroad in their search for trade, even if the mill-stone had not been a method unsuited for large production. It is true that Oliver Evans, an American, made material improvements in 1790. His contrivances were simple, but, as they advanced the automatic handling of grain and flour, they were in line with developments which followed later, and were therefore valuable. He added to the milling plant of his day the elevator, the conveyor, the drill, and other devices. Labour-saving was the object of Oliver Evans's improvements and they were welcomed and adopted, although, like many inventors of flour-mill machinery, he was but poorly requited by pecuniary success; his name, however, occupies a deservedly high place in milling annals.

After Evans's time there came a lot of petty inventions of more or less merit. Various improved methods of dressing mill-stones were introduced; increased care was exercised in the selec-

tion and treatment of mill-stones, the choicest of which came from French quarries; there were new devices for levelling bed-stones, better balance boxes for the runner, and silent feeders and exhaust to take the hot air from the stones. In the

seventies several mechanical devices were invented for dressing mill-stones. These had undoubtedly merit, but they came into being too late to enjoy great success, and it was but a few years until the mill-stones they were intended to work upon became obsolete, and their occupation was forever gone. These machines are worthy of note, not only because of their ephemeral intrinsic value, but also on account of a permanent contribution their inventors

made to the American milling industry which still endures and will probably exist as long as the trade lasts. In the endeavour to introduce their machines to the milling public, they found no printed medium at hand and therefore proceeded to establish one of their own. Rival machine-makers began the publication of two milling journals, the primary object of which was to exploit their stone-dressers. This was in 1873, and al-



An American Operative Miller.

though the machines they were created to advertise passed out of use with the mill-stone, the journals themselves survived and found an opportunity for expansion in the awakened interest of American millers in milling devices and improvements. Although British milling was far older than the American industry, it did not possess a trade journal until those in the United States were established. It is significant of the change in the character of the milling trade which came with the new process, that before its advent agricultural journals were probably quite sufficient for the miller as well as the farmer, but after its introduction, he required a distinctive trade literature of his own; a want which the publishers of the two leading milling journals were quick to see and supply, with the result that although the machines are almost forgotten, the journals established to advertise them are flourishing and successful publications.

In the matter of progress in milling methods the first seventy years of the nineteenth century was a brooding period. The trade was getting ready for a radical and astounding change such as few industries have ever known. This reform was to sweep everything before it in its sudden and unexpected onslaught, to overwhelm all opposition, ruin those who stubbornly clung to old ways, enrich those who were alert and progressive, break down all barriers, divert established trade channels, open up new fields for American grain-growing, utilize opportunities which had long lain dormant, effect a complete change in the industrial map of the American northwest, build railroads, create new routes to the old markets, reduce freight rates, immensely cheapen and improve the bread of the

old as well as the new world, drive out of commission in Britain and America thousands of time-honoured old-fashioned mills unable to compete in the new order of things, and bring into being flour-mills of a capacity such as the world never before dreamed of.

During the brooding period antecedent to this era of activity and progress, millers generally, although of a somewhat sluggish and narrow business habit, were prosperous. Flour commanded a high price in the world's markets and there was good profit in milling. It was indeed the golden age of the mill-stone. Several important milling centres developed in the United States, the flour from which became famous in the home markets. Although the European export trade did not become very large until later, there had existed for many years a steady and remunerative demand for American flour in the West Indies and South America. About 1823, when the Erie Canal was opened, Rochester, N. Y., became an important milling-point, a position it maintained for twenty years, during which its title, "the Flour City," was well sustained. Richmond, Va., was a large producer of flour, and one of its brands, the Haxall, marked the climax of excellence in mill-stone milling. New York city had several valuable mills doing a satisfactory domestic and foreign trade. St. Louis, Mo., was the prominent western milling centre, and the standard of flour was kept at the highest point by its millers, who had a large and growing trade throughout the west and south. The flour of the time was made entirely from winter-wheat except in States where only spring-wheat could be obtained, and there the demand for it was merely local. The coming of the puri-

fier made spring-wheat flour valuable; before its invention and use it was regarded as far inferior to flour from winter-wheat, being strong, but of poor colour. The method of milling then in use was such that the intrinsic value of spring-wheat was unknown and unsuspected. There were a few insignificant mills in Minneapolis, attracted to the spot because of the cheap water-power afforded by the Falls of St. Anthony, but doing only a local trade. Throughout the entire United States the flour-mills were comparatively small. In 1870 there may have been a few mills capable of producing 1,000 barrels daily, but these were regarded as exceedingly large. This figure is now considered merely the unit of capacity for successful modern milling in America.

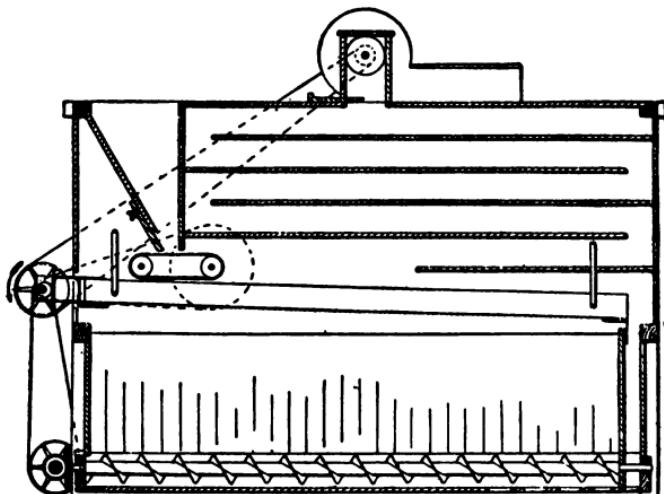
A machine was introduced in Minnesota in 1870 which was to milling what the reaper was to agriculture. No other one machine ever accomplished what it did for the world of bread-eaters. About the time of its introduction good flour sold for ten dollars or more a barrel. The average price for patent flour in these days is about one-third of its average then. The machine itself did not reduce the cost of making flour, but it enabled the miller to grind from the hitherto despised spring-wheat a product which immediately commanded a price equal to the best winter-wheat flour. This gave a great impetus to milling in the northwest, increased the demand for spring-wheat, rendered valuable the crops of Minnesota, the Dakotas, and western Canada, and led to the agricultural development of that section of the western continent. Spring-wheat flour sprang into favour in America, and when introduced abroad, especially in the United Kingdom, won

its way against all competition. In the end, the demand for it caused British millers to remodel their mills and grind a mixture of home-grown and American wheats.

Undoubtedly the invention of the purifier, which was merely a device for separating middlings and flour, was French. In a French work by Benoit, published in 1863, the purifier is fully and accurately described. Perrigault secured a patent for a middlings purifier in France on August 16, 1860. To Edmund N. La Croix, a native of France, belongs the honour and credit of introducing and building the first purifier in America. The poor man received nothing else from the machine which made millions for others and changed the industrial future of the northwest, having been treated most shabbily by the organized millers of his time as well as by those who pirated his invention or adaptation, and the distinction given him here is his due. The purifier of Perrigault may have been the original of his machine, but had not La Croix built a similar one in Minneapolis in 1870 the process it inaugurated would not have become known until later, if ever, and the loss would have been incalculable. La Croix was an educated Frenchman, but unaccustomed to business ways, and lacked knowledge of the English language. Had he been shrewder and more suspicious, he would not have allowed the fruits of his work to escape him, and he might have obtained some of the millions which went to others as a result of his experiments.

The history of the purifier is an unwritten industrial romance. Fragments of it have been told, but the entire story is a trade legend, abounding in dramatic facts rivalling fiction,

which awaits the coming of a comprehending novelist to weave it into a tale of absorbing interest. Briefly, the story is this: La Croix came to Minneapolis in 1870, and there built for a miller



The La Croix Purifier.

the first purifier known in America. For ten months the machine was operated successfully in the main, although it was crude. La Croix was immersed in his work, constantly experimenting and devising improvements. One fault with the device was that it became clogged with flour. The Frenchman planned an automatic brush to overcome this difficulty, but was slow in perfecting it, and careless in discussing his plans. In the same mill in which the purifier was being operated there was employed a stone-dresser, a coarse, unlettered workman, huge in stature, ponderous,

sensual, and taciturn, yet possessed of a sort of underhanded cunning, which in this instance answered his purpose exceedingly well. This stonedresser, Smith, realized the possibilities of the new machine, and lost no time in securing its control for himself. He claimed to have invented the purifier and the attached travelling brush, and perhaps he did apply the brush to the machine.

While La Croix was experimenting and dreaming, Smith secured patents and thenceforth posed as the creator of the modern purifier, although he never subsequently showed the faintest trace of inventive talent. Smith went to Jackson, Mich., with his patents, and there succeeded in interesting capitalists in the invention. In 1878 the Smith Middlings Purifier Company was organized. The patents obtained by Smith were vested in a corporation formed for the purpose of controlling all purifier patents obtainable, and the Smith Company was licensed as sole manufacturers under it. In order to secure a monopoly of the purifier business, suits were brought against millers who were operating purifiers not made under Smith's patents. By this time the value of the machine had become known, the new process of milling had started and thousands of purifiers were in use. The suits were met by the millers, who joined together to defend themselves in an organization called the Millers' National Association. The litigation cost the allied millers \$100,000 for attorneys' fees in obtaining evidence and preparing to meet the issue in court. In 1880, while the suits were pending with every prospect of a decision favourable to the millers, the matter was, for some unknown reason, settled out of court by a compromise whereby the purifier claim-

ants agreed to dismiss the suits, and the members of the millers' association were licensed under a royalty to use the purifiers in their possession, they agreeing to thereafter purchase no "infringing" machines.

This gave the Smith Company a virtual monopoly of the purifier business, and competing concerns were forced to abandon the field. The unfortunate La Croix, meantime, chagrined at being outwitted, left Minneapolis and soon after died broken-hearted and poor. He bequeathed his patents to his family. During the litigation between the owners of the Smith patents and the millers, the wife and daughters of La Croix were living in Rochester, N. Y., in humble circumstances. To them came the legal representative of the purifier company, offering a large sum for the La Croix patents, which were needed to strengthen the claimant's suits. Knowing that the object of the purifier company was to harass the trade, and relying upon the individual assurance of millers that their action would be properly appreciated, the heirs of La Croix, with a rare spirit of self-denial, refused this offer, although they were greatly in need of money. La Croix's brother organized the La Croix Purifier Company in Indianapolis, and sought to manufacture machines under his brother's patents for the benefit of the La Croix heirs. In this undertaking he was succeeding reasonably well when the settlement of 1880 between the millers and the purifier claimants occurred. This gave the monopoly of the business to the Smith Company, and the very millers who had profited by the honourable conduct of the La Croix heirs made it impossible for them to gain a living by making and selling puri-

fiers. This act of ingratitude was probably completed by the Millers' National Association without a realizing sense of the effect upon its defenceless allies, the La Croix family. It is hard to believe that reputable millers would deliberately abandon those who had been loyal to them in their long fight, and it is possible, though inexcusable, that in their anxiety to conclude a tedious and expensive contest, they forgot the existence of these modest but deserving people; otherwise they might easily have provided in some way for a satisfactory purchase of the La Croix patents, and thus have properly acknowledged and rewarded the loyalty of the family. The result meant ruin for the unfortunate heirs of La Croix. The manufactory at Indianapolis was abandoned, and the little family in time came to know absolute and bitter destitution. So acute did this become that very recently a milling journal, learning of it, made an appeal in behalf of the survivors, by which a purse of a few thousand dollars was raised and given to the La Croix heirs as a belated but slight recognition of their services to the milling industry. Given a monopoly of the purifier business, the Smith Company made immense sums. At first, the ex-stone-dresser was wise enough to allow the business men associated with him to manage the concern while he travelled and spent his income according to his own untrained and freakish fancy, but later he insisted upon taking the administration of affairs into his own hands, and his abler associates withdrew. This was the beginning of the end. Reckless and foolish extravagance, silly and showy excesses and bad business methods, soon undermined the once flourishing establishment, and ten years after

it had secured a monopoly of the business, the Smith Company collapsed in a disastrous and disgraceful failure.

To return to the course of the milling revolution, or rather to its initial stage—new-process milling. Certain mills in Minnesota early discovered that by virtue of “high grinding” and purified middlings they could produce a flour which found eager buyers in the east willing to pay an unprecedented price for it. The mill at Hastings, Minn., owned by Stephen Gardner, was a pioneer in this method; so also were the mills at Northfield and Dundas. A few of these “country” mills, as they were called, were somewhat quicker to put the new method into practical use than the mills of Minneapolis, but that city was the centre from which, for many years after, the waves of milling progress radiated. Soon after the purifier was introduced, Minneapolis became, by reason of its increase in flour production, the most important milling centre in the world. When, in 1870, La Croix built his first machine, the Minneapolis millers were ready to seize upon any opportunity and push it vigorously. It happened that the group of men then interested in flour-making on the Falls of St. Anthony were of the exact type necessary to fully develop and expand new ideas in milling. Among them were some whose names have since attained world-wide celebrity in connection with flour, and who were capable of soundly establishing the foundations of the giant industry which followed their initiative. Governor Cadwallader C. Washburn was the miller of broadest vision and greatest foresight who realized more than his fellows what great possibilities the future might have in store

for the new milling city. Of extraordinary strength of mind and executive ability, indomitable energy and large financial resource, he arose to his opportunities to the fullest degree, and lived to see his confidence justified by results.

Mr. George H. Christian was the first in Minneapolis to experiment with the purifier, and it was in his mill that La Croix built the original machine. Subsequently, Mr. Christian brought his keen, logical mind and his genius for business to bear on the milling problems of the time, and solved them

to his satisfaction. Mr. Charles A. Pillsbury, decidedly one of the greatest merchant millers who ever lived, was fortunately in the milling business at the beginning of the new process, and by his promptness in adopting modern ideas, his courage in exploiting them, and his talent for extending and building up trade connections, founded the great establishment which now bears his name. Besides the Washburns, the Pillsburys, and the Christians, there were other millers in Minneapolis at that time who were of the



Governor C. C. Washburn.



Mr. C. A. Pillsbury.

stuff necessary to control large and developing interests, and they did their part well in the building up of the largest milling centre in the world.

In 1871-'72 the purifier began to be used by the Minnesota millers, and profits ranging from one to three dollars a barrel on the product of the mills were soon realized. With such a stimulus, the milling industry in the northwest made great strides, and its progress amazed and troubled flour-makers elsewhere, stirring the whole milling world at home and abroad with a vague spirit of unrest and uneasiness.

An era of improvements began which was to last for years. Until this time spring-wheat flour had never been sold abroad direct from the mill; indeed it is doubtful if it had found its way there indirectly in quantities worth considering. It was Governor Washburn who, in 1877, said to Mr. William H. Dunwoody, his associate in business: "Go to England. Start the people there to buying our flour, and where stand these mills, which now seem so large, will be erected others far surpass-



Mr. George H. Christian.



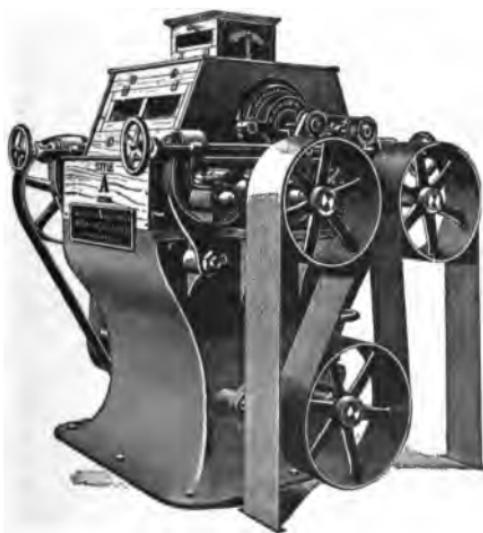
Mr. William H. Dunwoody.

flour, and where stand these mills, which now seem so large, will be erected others far surpass-

ing them in importance and capacity." Mr. Dunwoody did so, and after overcoming much prejudice and opposition finally succeeded in establishing a demand for his flour in England. This was the beginning of the spring-wheat flour export trade. In 1902 Minneapolis alone shipped more than three million barrels of flour to foreign countries, and Mr. Dunwoody, now one of the wealthiest millers in the world, has lived to see Governor Washburn's prophecy fully realized. On May 2, 1878, a fire in the Washburn A mill caused an explosion of flour-dust, which completely destroyed the most important of the mills and killed a number of operatives. Dust-collectors had not then been invented, and the busy mills were filled with a fine dust which under certain circumstances became as inflammable and destructive as gunpowder. To this was due the catastrophe which temporarily checked the growth of the Minneapolis milling industry.

The morning after the disaster the indomitable millers set to work to rebuild their plants. Such was their sublime confidence in the future of the business that they planned the reconstruction on a greatly enlarged scale. They were unaware that a still greater change in milling methods was impending, and that the days of the old and tried mill-stone were numbered; therefore the rebuilt mills were all equipped with stones for grinding and purifiers for the separation of middlings. Several years before this rolls had been introduced into America by Edward P. Allis & Co., mill-builders, whose milling engineer, Mr. William D. Gray, had planned and built some of the most important mills in the country. At first these rolls were of marble, but later of porcelain, imported from

Zürich, where they were made by the house of Weggmann. At the time of the rebuilding of the Minneapolis mills the roller process, which soon succeeded the mill-stone, was considered altogether too experimental for practical use. Governor Washburn during his foreign travels had seen the rolls at work, and from curiosity had ordered a few sets; these had arrived in Minneapolis, but were still unboxed. He contracted with Mr. Gray in 1878 for a small experimental roller-mill, and



Modern Roller Mill.

when completed this was the first complete roller-mill in the United States, and probably the first complete automatic roller-mill in the world. Chilled-iron rolls soon succeeded the porcelain variety, and this type of grinding machine, beau-

tifully made and carefully adjusted, then began to displace the mill-stone throughout the milling world. In a few years all the plants in Minneapolis were roller-mills.

The substitution of rolls for mill-stones was the most radical advance ever made in the science of milling. It is claimed by the Hungarian millers that the Americans appropriated their methods, and that to the millers of Budapest belongs the credit of having been the first to adopt the roller process of making flour. The Americans do not claim that the roller-mill was invented by them, nor do they deny that steel rolls were in use in Hungary before they were adopted in the United States. They insist, however, that their system of milling automatically by means of rolls is their own, and that the roller-mill was neither invented nor first used in Budapest. The Hungarian roller-mill-makers claim that the first roller-mill plant was installed in Budapest in 1874; that rolls were shipped by them to Minneapolis in 1878, to Switzerland, the United Kingdom, and Russia three years earlier, and to France in 1876. This may all be quite true; nevertheless the claim that chilled-iron rolls took their origin in Hungary is fallacious. The Farrell Foundry of Ansonia, Conn., entered an order on September 21, 1874, for chilled-iron rolls for George H. Christian & Co., of Minneapolis. However, in seeking for the origin of the type of roll now in universal use one must go back fifty years further. Unquestionably the inventor of the roller-mill was Helfenburger, who in 1820 built and experimented with the first roller-mill at Rohrschach, Switzerland. This was never developed. Jakob Sulzberger, of Frauenfeld, Switzerland, invented the first successful sys-

tem of grinding cereals by rolls. His mill was built in 1832 and started in 1833, and was an immediate and complete success. The honour of the invention, as well as the practical adaptation of chilled-iron rolls for making flour, belongs unquestionably to Switzerland, and there is no lack of evidence to prove it. Sulzberger subsequently erected roller-mills at Mayence, Milan, Munich, Leipzig, and Stettin, and in 1839 the Pester Walzmühle of Budapest was equipped with chilled-iron rolls made in Rohrschach by Helfenburger, and finished by Sulzberger in Zürich. The Frauenfeld Mill Company, the original roller-mill, continued in business until 1846, when it became out of date, and its owners decided not to rebuild it.

During the early '8os rolls rapidly superseded the mill-stone in all the principal mills in the United



Interior of a Modern Mill.

States and Canada, and soon became the standard for new and modern mills the world over. The mill-stone had served its allotted time and was retired with high honours and pleasant memories.

It is now hopelessly obsolete, except in remote districts into which the latest milling inventions have not penetrated. These are few and far between in the milling sections of America. Following the purifier and the roll came a train of useful inventions which were incorporated in the roller system of milling—dust-collectors, scourers, bolters, separators, sifters, and other machines. After the radical changes incident to the revolution in milling, and the rebuilding and remodeling of many mills from stones to the roller system, the progress of the trade mechanically has been in the direction of minor improvements, and a closer attention to economy in cost of production, made necessary by the most intense competition, and the reduction of profits to a minimum. The introduction of the new system of milling utterly destroyed thousands of small rural mills in the United States which were not able to meet modern competition; in fact, it created a new type of mill of very large capacity, and had a tendency to concentrate mills at points possessing favourable shipping facilities. In the United Kingdom the competition of the large modern mills at the ports and the increased use of American flour has had a destructive effect upon the small rustic mill with its picturesque surroundings, and it is rapidly passing away. The mill of the twentieth century is a large manufactory of flour, with great capacity, employing many operatives, and managed by millers who may know but little about the mechanical details, but are wise in methods of selling, and especially careful in keeping the cost of production at the lowest figure possible; the competition being terrific. The science of milling to-day is exact and methodical,

being, in brief, to produce the utmost from the wheat at the least possible cost. The result is that the masses are receiving the best, purest, and most nutritious, as well as the cheapest flour ever known in the world's history. To this one great end all milling progress has steadily tended since the days of the quern and the saddle-stone.

Commercially, the millers of the United States outrank all others. Their mills are the largest and have the greatest capacity. The develop-



Small American Mill.

ment since the introduction of the purifier and the rolls has been such that American flour now competes successfully in all foreign countries from which it is not debarred by prohibitory tariffs. The number of mills in the United States, as shown by the census of 1900, exceeded twenty-five thousand, a very large number being mills of small capacity. These employed a capital of more than 200 million dollars, used nearly 490 million bushels of wheat annually, producing about 102 million barrels of flour valued at 348 million dollars. For the fiscal year ending June, 1902,

the millers of the United States exported nearly 66 million dollars' worth of flour. Minneapolis is the largest flour-producing city in the world. Its daily capacity is estimated at 70,000 barrels. The largest flour-mill in existence is the Pillsbury A, at Minneapolis, with a capacity of 14,000 barrels daily. In 1902 the output of the Minneapolis mills was over 16 million barrels; in 1878, when the experimental roller-mill was built, it was 940,000 barrels. The direct export trade in flour from Minneapolis was 109,000 barrels in 1878; in 1902 it was over three million barrels. Other milling centres in the United States which produce large quantities of flour are New York, Milwaukee, St. Louis, Kansas City, Chicago, Toledo, Indianapolis, Superior, and Duluth. Working with these centres to produce the enormous output of the nation are a large number of modern flour-mills, of a capacity exceeding the largest mills known in the mill-stone period, scattered throughout the principal milling States, all having their direct foreign and domestic connections and doing a thriving and important business. In Great Britain large mills have been erected during recent years, principally at the ports. Owing to the fact that they are able to secure American wheat at very low rates of freight, and because of the recently imposed tax on flour and grain entering Britain, which discriminates in favour of the home miller, these and other British mills of the modern type are meeting American competition and doing a prosperous business. France and Germany protect their millers by a tariff which prevents foreign competition. In these countries milling continues to be a conservative and rather sluggish industry not given to

many changes. In Canada, owing to the opening of the western wheat-fields, there is much activity in mill-building, and in the Canadian northwest there are several highly important modern milling plants which are developing into mills of the largest type, doing both a foreign and domestic trade.



An American Country Mill.

In New Zealand and Australia flour-milling is an important industry, but temporarily at a standstill owing to crop failures. The mills of Budapest, Hungary, are fairly prosperous, although their flour is no longer in as great demand in British markets as it was twenty years ago. In Holland, American competition has somewhat crippled the Dutch mills; but during 1902, owing to the freight discriminations in America against flour and in favour of exported wheat, they were able to regain some of their lost trade. In Belgium, the tariff has driven American flour out of the market, but the Belgian millers are far from happy owing to ruinous competition between themselves. The mills of Russia are seldom heard

from in the world's markets, but some of them are very modern in their equipment and evidently prospering. In Argentina flour-milling progresses slowly, but a few plants are making an effort to enter the British markets. In other South American countries the milling industry is purely local in its extent and influence. The British and American millers are engaged in an interesting struggle for the control of the flour trade of the United Kingdom, with the advantage in favour of the home miller because of the policy of American carriers in discriminating against flour for export in favour of wheat. The grist-miller all over the world is of rapidly diminishing importance, the merchant miller with his increased milling capacity having limited his trade and curtailed his operations.

CHAPTER XII

Transportation and tariffs—Britain's exposed position—American railways and freight rates—A discriminating policy—Its effect on American flour-milling—Traffic through the "Soo" canal—Neglected opportunities—Wheat "corners"—The Leiter deal—Continental tariffs—The cheap loaf—Bread riots—British tax on flour and grain—Preferential trade—International contest for world's chief bread-producer—Harvest calendar—Bread the food of civilization—The Anglo-Saxon holds the key

IT has been shown that in the production of both wheat and flour the United States is far in advance of any other nation. It is fortunate for the people of other countries that more is produced than can be consumed by her own citizens; and this condition will probably be perpetuated

for many years, because not only is the acreage susceptible of extension and the yield of material increase, but, should national irrigation plans be carried out, States which now produce little or no wheat will grow large crops; and, even if this should not happen, a shortage or even the prospect of a shortage in the world's wheat would advance the price, and thus stimulate farmers who have temporarily abandoned wheat-raising for more profitable crops to return again to the cultivation of the King of Cereals. It is unsafe to make prophecies in connection with wheat, as the discomfiture of the prophets of the past has proved; but it does not seem very hazardous to venture the opinion that the generation is yet unborn which will live to see the time when the United States is unable to send flour abroad because it does not make sufficient for its own needs. It may be taken as a fact that the United States is in the business of exporting wheat and flour as a permanency, or as long as other nations can afford to buy and pay for bread. It may be that Britain and other importing countries will have periods during which they can secure wheat supplies cheaper than from the United States, but until newer and more fruitful fields are developed, they must in the main depend largely upon America. Broomhall's Corn Trade Year-Book for 1902 says: "Under present conditions it seems quite likely that the production of wheat in these islands will sink to a mere 20 million bushels, whereas if the population increase during the next twenty years at the same ratio as it has done in the past twenty years, we shall have 50 million people to feed who will require nearly 320 million bushels per annum of wheat alone. On this basis

Harvesting Wheat, India.



the home production will be but 6 or 7 per cent. of the total, say four weeks out of the twelve months." Broomhall continues: "No man who is acquainted with the position of food supplies in Great Britain but knows for a certainty that America and Russia together could exact any terms from this country in six months by simply prohibiting the exportation of grain and provisions. How long will it be before America alone becomes the arbiter of our fate?" To the onlooker it would seem strange that a country in such an exposed condition should trifle with its source of supply by taxing the imports of wheat and endeavouring to discourage especially the imports of flour; but this is exactly what the statesmen in the British Parliament did recently, and no one applauded the act more than the authority quoted, who is of the opinion that, although Britain cannot raise more than 7 per cent. of the wheat which will be required to feed her people, her millers are entirely capable of supplying them with flour, and that the United States will always be quite willing to furnish them with the raw material if the manufactured product is discriminated against.

While the agriculturists of the United States have sowed and reaped, and its millers have advanced with the progress of wheat-growing, both would have been unable to attain the strong position they now occupy in the world's markets had it not been for the co-operation of the inland and ocean carriers. It must be admitted that the great expansion of the railways of the country and the steady reduction in freight rates, accomplished by an increase of facilities for moving the traffic economically, have been the great factors in the

upbuilding of the export trade in wheat and flour. The people of no other wheat-growing nation have been favoured by as low rates of freight as the Americans. The railroad of the west extended its rails into promising fields as soon as, and more often before, their freight-producing capacity was known. In 1871, when the true quality of spring-wheat was discovered, the railroads in the United States operated 44,600 miles; in 1897 181,000 miles were in operation. The reduction in the rate of freight per ton per mile has more than kept pace with the increase in mileage; in 1859-'60 the average rate was three cents per ton per mile; in 1896-'97 it was four-fifths of a cent. On one railway—the Chesapeake and Ohio—the average freight rate per ton per mile in 1862 was seven cents; in 1897 it was two-fifths of a cent. There exists two methods of shipment from the west to the Atlantic seaboard—one all rail; the other, available during the season when navigation is open, by lake and rail. From 1858 to 1862 the average all-rail rate on a bushel of wheat from Chicago to New York was $38\frac{1}{2}$ cents; from 1863 to 1867 $31\frac{1}{2}$ cents; during the next five years it fell to $27\frac{1}{2}$ cents; again declining to $21\frac{1}{2}$ cents in 1873-'77; in 1882 the average for the preceding five years was $16\frac{7}{10}$ cents; this was reduced during the ensuing term to $14\frac{1}{2}$ cents; from 1888 to 1892 it was $14\frac{1}{2}$ cents, and for the five years ending with 1897 it was $12\frac{1}{2}$ cents. The reduction in lake and rail rates was even greater. From 1857 to 1861 the average rate on a bushel of wheat shipped by lake and rail from Chicago to New York was $22\frac{1}{10}$ cents; from 1847 to 1880 it was $10\frac{1}{2}$ cents, and from 1893 to 1897 it was less than five cents. From New York to Liverpool the cost of carry-

ing has been reduced at times to an absurdly low figure. In December, 1900, it was only five cents per bushel, and since then there have been times when it was as low as two cents, and, not infrequently, it has been carried across the ocean as ballast. Surely in the matter of reaching the foreign market the wheat-raisers of the United States have been given most extraordinary facilities and rates by the carriers, and they at least should have no cause of complaint on this score; indeed the American railways have gone to such extremes in their competitive struggle to carry western wheat crops that they have very seriously injured another industry far more important to the country at large than the mere raising of grain—the exporting of flour; and the American millers have a logical and well-founded grievance against a transportation policy which results in hauling the raw material at unprofitable rates and discriminates against the product made from it.

For many years the American railways as well as the steamships have insisted upon charging a far higher rate for carrying export flour than wheat. There was a time when a reasonable discrimination in favour of the raw material was excusable. This was during the earlier years of the development of the trade abroad in flour, when large shipments were not obtainable and cars were small and seldom loaded with flour to their maximum capacity. In recent years the growing importance of the American merchant mills and their increased foreign trade enabled their operators to ship for export in very large quantities—in train-loads not infrequently—and to load every car to its greatest capacity. Such being the case, there exists no good reason why export flour should

be discriminated against in the matter of rates, except that in the management of many of the so-called "trunk lines" reaching the Atlantic seaboard there has grown into power a type of autocratic and automatic railway official who holds his place by virtue of long service or the influence of powerful stockholders, and who insists on maintaining in force an obsolete policy, the unreasonableness and injustice of which he is too thick-witted to understand or too stubbornly conservative to admit. This element is as yet sufficiently strong in railway councils to effectually stifle any reform in the direction of fairer traffic regulations.

The reasons why export flour should take the same rate of freight as export wheat are so numerous and self-evident that only the densest and most antiquated of railway officials fail to admit their soundness. On the broad ground of the national welfare, in which railways inevitably share, there is everything to say in favour of aiding, as far as is compatible with self-protection, the manufacture within the limits of a country of such products as are natural to it and for which the raw material is at hand, thus encouraging the employment of labour and capital and building up an industrial as well as a purely agricultural community. There is beyond this, in this particular instance, a principle of fair play and justice involved which railways should be the last to disregard. A quarter of a century ago there was only an insignificant demand for American flour in Great Britain, and hard wheat itself was not imported there from the United States. As already related in the preceding chapter, the courageous and enterprising American miller went to

England, and in the face of the bitterest opposition succeeded in creating a market for his flour. It was so superior to the average article produced in Britain at that time that it soon began to grow in favour with the consuming public, displacing to a large degree the dark inferior product of the old-fashioned mills then existing in the United Kingdom. The rapid development of new-process milling in the United States and the increasing demand for American brands of flour stimulated a belated revolution in British milling. In time modern roller-mills took the place of the antiquated mill-stone plants, and, adopting machinery similar to the American type, the British miller was again able to meet transatlantic competition, providing he could secure American wheat to grind at a low cost. The demand for the wheat itself, therefore, sprang directly from the high reputation attained for American flour through the long, expensive, and arduous efforts of the American miller, who performed the pioneer work of introducing the commodity, and demonstrating to the consumer its superiority over the British article. Finally, beside the matter of national welfare and the principle of fair play which this discriminating policy opposes, the direct selfish interest of the carriers should incline them towards fairer treatment of the exporting miller. The wheat-crop is moved chiefly during certain months of the year. Stimulated by low rates of freight, the wheat is hurried out of the country in a movement which congests traffic and frequently blocks the roads; cars are scarce, and other and more profitable freights are disregarded and delayed in order to accommodate the wheat exporters. The transportation interest, both inland and ocean, is best

served by a continuous, steady, and regular movement of freight from west to east, aided as much as possible by return freights. It is poorest served by irregular shipments at low rates, which congest the traffic at one season of the year, making it difficult to haul the freight for lack of cars, giving nothing to be handled during the rest of the year, and finally bringing back no return freights. This proposition must certainly be conceded as sound: that it is highly desirable from a railway and steamship standpoint to have an even, regular, and steady supply of freight the year around at moderate rates rather than an immense amount of freight during one season only at low rates. Such being the case, the transportation interest proceeds during the early portion of the crop year to invite enormous freights, to congest its movements, and to destroy all chance of return freights by putting in force a ruinously low cut rate on wheat, denying the same to flour on the supposition that the movement of flour can come later.

The result is exactly this: The low rate stimulates the export of wheat. It enables the foreign miller to buy American wheat on a basis far below what it costs the American miller. Enormous quantities of wheat are hurried abroad at cut freight rates until the demands of the foreign millers are satiated. Then a lull follows, and the transportation interest looks to the neglected American miller to supply it with freight, the demand for wheat from abroad having been satisfied. The American miller is anxious to export his flour, and endeavours to obtain offers from abroad which will enable him to do so. He is, of course, met with the competition of the foreign miller, who has fortified himself with American wheat

carried at a low rate at the beginning of the season by the accommodating American transportation lines. If he did not have this wheat he could not compete at all, as the consuming public has been educated to demand a flour equal to that made in America. If he had not bought his wheat at a less price than the American miller he could not compete, because the American can make flour cheaper than he. Having been supplied with cheap American wheat, however, through the stupidity and short-sightedness of the carrier, he is enabled to make a low price on his flour. This price the American miller must meet. In order to meet it he must secure a low freight rate. In order to get tonnage the carrier must have flour; consequently the carrier must give a rate low enough to enable the American to effect the sale. Hence it finally comes about, if indeed any flour is exported at all, that the carrier must take it at a rate low enough to meet conditions which it has itself created at the beginning of the season. Thus the carrier sows the wind in June, July, August, and September, to reap the whirlwind for the following eight months of the year. Thus it is that the carrier is heard to complain bitterly of the low rates on export flour; and, finally, thus it is that the system complained of is stupid, suicidal, and short-sighted, even from the transportation standpoint.

Another point which is ignored by the carrier in the consideration of this subject is the transient nature of the wheat traffic. One year, if there be a surplus of wheat in America and a shortage in Europe, American wheat must go forward in response to foreign demand. The American carrier gets the haul, but the delivery

of the wheat ends the transaction. There is no continuity in the trade, no permanency in the traffic. American wheat delivered in Europe adds nothing to American steadiness of trade, and builds up no permanent basis of commercial intercourse. It is due to a mere accident of nature which gives a shortage in one country and a surplus in another. The following year Russia may be a great wheat exporter, or Argentina. Perhaps Europe herself has a good crop, and the demand for American wheat slackens. Then the American carrier, as a matter of course, loses the traffic. The fact that it transported millions of bushels one year does not assist it to carry a single extra bushel the year after. If, however, the American carrier is engaged in transporting American flour, the result is far different. The flour has an identity impossible to lose or to duplicate. Every sack of it carried abroad and consumed is an earnest of two sacks to follow later. The effect of transporting American flour is to establish and build up a permanent and increasing trade—a trade that can only be supplied from American sources by means of American carriers ; an exclusive, continuous, and developing trade beneficial alike to carrier, miller, and farmer. The point is this : American wheat, if not easily procurable, can be displaced by wheat from other lands—Russia, Argentina, Australia. American flour, however, can only come from the United States, and can only be carried by American transportation lines. The permanency and continuity of the flour trade is such, therefore, that were there no other arguments to be adduced in favour of assisting its growth, this alone would be sufficient to warrant a broad-minded, far-seeing

transportation interest in not only giving it a fair and equal chance, but in actually encouraging it by every possible favour in competition with the export of wheat.

In the foregoing the disadvantages of the present policy of the carrier have been incompletely and imperfectly given. From the miller's standpoint, it is simply ruinous. Seeking a foreign market with a manufactured product, he naturally opposes prejudice and tradition favourable to the home miller. With infinite labour, great expense, and dogged tenacity of purpose, he finally succeeds in establishing an export trade, the profit on which at the best is very small. It gives him, however, an additional outlet for his product and enables him, by running more steadily and regularly, to manufacture his whole output at less cost. Having finally demonstrated the superior value of his flour to the satisfaction of the foreign consumer, he naturally expects in time to enjoy the fruit of his arduous and intelligent effort. If America be blessed with plentiful crops and there is a shortage abroad, he hopes to supply at least a portion of this shortage with the product of his mill. He knows that he can make flour as cheap as, or cheaper than, his foreign competitor. Therefore, if he is given an equal show in the matter of freight rates, he can easily hold his own with all comers. All his calculations are upset, however, by the inscrutable policy of the transportation lines, which, in their foolish eagerness for tonnage with which to make a showing in competition with others, seize upon the wheat as soon as it is harvested, and by collusion with a few favoured wheat-handlers rush it out of the country at a ridiculously low freight rate,

made surreptitiously and in defiance of law. Before the American miller has an opportunity of even showing samples of his flour made from the new crop, a very large part of the harvest has been shipped abroad at rates of freight rigorously denied him. He meets in the foreign market a competition, in the form of flour made from his own wheat, delivered to the local miller at rates far below anything he has been able to secure. This fearful handicap remains throughout the crop year and simply blights and destroys his market. The American miller is thus struck with a club grown in his own country and kindly presented to his enemy by his own short-sighted countryman, who blandly comes around later and begs to be favoured with a share of his valued business.

In the summer of 1901 this discriminating policy was carried to such a ridiculous extreme both by the railroads and the steamship lines that the British, German, and Dutch millers were provided with a stock of the best American wheat, at rates of freight which were nominal, sufficient to supply them with raw material during the following year, and by this means alone they were enabled to defy American competition and reduce by a very large amount the export flour trade from the United States. Since then the transportation interests have pursued a less reckless policy in the matter of discriminating against flour, and the American millers are slowly and painfully recovering some of the ground they lost, but it will be years before their export trade recovers from the effects of the attack. It is the hope of the American flour manufacturer that the effect of the vast railway consolidations, and the creation of the recent steamship combination, will

be to eliminate from control the short-sighted officials who persist in such unwise discriminations. Realizing that every bushel of wheat exported unground represents a lost opportunity, he confidently expects that the new era in railway operation will bring a wider and more liberal treatment of such traffic problems. If it does not do so, he will assuredly favour Government control of the railways.

Although the increase of railways has been very great and the reduction of freight rates satisfactory, the American farmer and miller expect still greater facilities and lower rates. There are opportunities awaiting development in various directions. The improvement of the Erie Canal and the reorganization of its system of freight-carrying would enable western products to find their way to the ocean without the use of the rails by an all-water route extending from Duluth to New York, thereby avoiding the expensive haul from Buffalo and the extravagant terminal charges at New York, which have done so much to drive commerce away from that port. An idea of the traffic in grain and flour which finds its way down the Great Lakes may be obtained from the report of the business done in 1902 at the Sault Ste. Marie Canal. More than 76 million bushels of wheat and nearly 9 million barrels of flour passed through this channel, and the amount of money paid for freight into and out of Lake Superior during the season of 1902 is estimated at 29 million dollars, while the value of the freight itself was about 350 million dollars. The waterways of the United States have not been developed as yet to anything approaching their full possibilities as freight-carriers. Besides the Erie Canal in the

east, a neglected opportunity in the west is the Mississippi River. Given a proper system of transportation and modern freight-carriers, there exists no good reason why, through this great natural channel which reaches from Minneapolis to the port of New Orleans, a very large portion of the flour and grain from the northwest for the foreign trade should not find an easy and cheap outlet, entirely free from the exasperating and expensive handicaps imposed by the eastern railways and their terminals.

Two objects interpose between the wheat-raiser and his hungry customer, the bread-eater, and both are unnatural. Tariffs upon flour and grain are imposed in many countries, and serve to increase the cost of the loaf by shutting out foreign competition in providing it. "Corners" in wheat, whereby the price is advanced to an artificial and unnatural basis, are not infrequent. These devices are usually the creation of ambitious Chicago wheat operators, although they sometimes originate elsewhere. The last important attempt in this direction was conducted by Mr. Leiter, of Chicago, who for a while controlled the wheat markets of the world. Never in history has an operator in wheat made such a bold attempt as this young gentleman, and at one time in his meteoric career his profits were 5 million dollars, but this huge sum and much more was lost in the end. Wheat bought by him as low as 64 $\frac{1}{2}$ cents was forced to \$1.85 a bushel. He controlled at one period 35 million bushels of wheat and owned as much as 14 million bushels of actual cash wheat. In the course of his famous deal he exported and sold 25 million bushels. The cause of his final collapse was the early harvest-

ing of a new crop. In his novel, *The Pit*, Mr. Norris describes the reason for a similar failure in words which apply equally well to Leiter's disaster. "Corner wheat!" exclaims the operator, "corner wheat! It's the wheat that has cornered me. It's like holding a wolf by the ears; bad to hold on, but worse to let go." Then followed his downfall. "It was the wheat, the wheat! It was on the move again. From the farms of Illinois and Iowa, from the ranches of Kansas and Nebraska, from all the reaches of the middle west, the wheat, like a tidal wave, was rising, rising. Almighty, blood-brother to the earthquake, coeval with the volcano and the whirlwind, that gigantic world-force, that colossal bellow, Nourisher of the Nations, was swelling and advancing." Against such an overwhelming force Leiter, like the hero of Mr. Norris's story, was unable to stand, and an enormous loss closed his career in the wheat market.

Such manipulations are merely temporary interruptions to the legitimate course of the world's wheat, but tariffs are permanent obstructions designed to prevent it from seeking its natural level, and resulting in additional burdens for struggling humanity. The cheap loaf is the requirement of the masses, and as such would seem to be a political necessity. In countries where it is made dear by tariff regulations, bread-riots and widespread dissatisfaction among the people are the ultimate and legitimate result; yet European statesmen still cling to such methods of raising revenue under the guise of protection to the farmer. If given free access to continental markets, the American miller and his British competitor could put the price of bread far below its present cost to the

consumer, and at the same time vastly improve the average quality and wholesomeness of the people's food; but the tariffs imposed are a barrier to such a proceeding. In France the duty on flour is prohibitory, being from \$1.86 to \$3.37 a barrel; the German tariff, \$3.21 a barrel, shuts out foreign flour absolutely. Sweden's tariff is \$1.50 a barrel, that of Spain \$2.25, of Belgium only 34 cents, but sufficient to stifle the foreign flour trade and give the native millers a monopoly of the business. The duty in Norway is nominal, and Holland and Denmark are alone in admitting flour free. Great Britain, until the spring of 1902, was among the nations which gave flour and wheat free welcome to their ports, but at that time, under the spur of alleged necessity, her Government reversed its traditional policy, and in principle, although not in the same degree, reverted to a system of raising revenue by the taxation of foreign grain and flour which was tried nearly ninety years ago, and found to be such an utter mistake that its downfall was hailed with universal rejoicing among the masses.

For more than thirty years British ports had been absolutely free to all comers who brought food to the people. The memory of the obnoxious corn laws had evidently grown faint in the minds of the people, and the magnificent struggle which was led by Cobden and Bright, and which ended in the repeal of these laws, was evidently forgotten. Nations have short memories; were it otherwise, Britain would not have been unmoved when Sir Michael Hicks-Beach, Chancellor of the Exchequer, proposed in his budget of 1902 to raise revenue by going back to the principle of taxing the people's food.

It is true that the duty was comparatively small, that it was not presented as a tariff, but under the thinly disguised mask of a "registration duty"; it is equally true that the need for increased revenue was great, and that other methods of taxation had been practically exhausted; furthermore, the pill was coated by the inference that the measure was merely temporary. The insidious and apologetic manner of its introduction suggested the mental attitude of the half-remorseful peculator who takes a small, a very small, amount from the till which he should consider sacred, because his need is very great and the "loan" is only temporary. Disguise it in any and every possible way, the fact remains that the tax on foreign flour and grain was the re-enactment in embryo of the universally reviled corn laws. The difference between the act of 1815 and that of 1902 was that of degree only. The bread-box of the people is a sacred charge, and when a government under sore temptation dips its hand into it and pinches therefrom ever so small a particle, it has taken a step on the downward course which logically ends in bread riots and starvation.

The present British tax is 3*d.* on 112 pounds of wheat and 5*d.* on the same amount of flour and its products; as it affords considerable protection to flour made in the United Kingdom, it is exceedingly welcome to the British miller, for whom it comes at an opportune time. With this aid from the Government, and the kindly co-operation of the American railways in giving him wheat carried to his door at a much lower rate than that given American flour, he feels quite prepared to meet any foreign competition that

may seek his markets, and he may well be. Between Britain and Canada and other colonies there is much discussion of preferential trade which may ultimately result in action, but so far as wheat is concerned, Britain would take great chances in discriminating against her present sources of supply in favour of Australia and New Zealand, where the crop is uncertain, or even Canada, where early frosts are apt to occur, as they did in 1902, and greatly damage the value of the wheat. Should such arrangements be made to the detriment of American importations, Britain will be almost certain some year to find herself short of flour, in which case her people, being hungry, are quite equal to an assertion of their right to cheap bread, regardless of political plans and pestilential rather than preferential, will designate their opinion of a trade which denies this necessity to them.

In 1901 the crop returns of the principal nations of the world placed the producers of wheat in the following order :

1. United States. 2. Russia. 3. France. 4. India. 5. Austro-Hungary. 6. Germany and Italy. 7. Canada.	8. United Kingdom. 9. Australasia. 10. Argentina. 11. Belgium. 12. Holland. 13. Sweden. 14. Denmark.
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As already explained, many of these countries do not raise enough to supply their own needs, and are therefore importers of wheat.

Viewed from any standpoint, the international contest for the position of purveyor-in-chief to the world's bread-basket is an intensely interest-

ing one. The great centres of demand stand still while the centres of supply retreat, modern transportation systems supply the connecting chain which keeps the world from going hungry. Of this there is no danger, for nature, to the confusion of the speculator, has arranged a wheat calendar whereby during every month of the year somewhere on the earth's surface a crop of wheat is harvested. In January, Australasia, Chili, and Argentina; in February and March, East India and Upper Egypt; in April, Lower Egypt, Asia Minor, and Mexico; in May, Algeria, Central Asia, China, Japan, and Texas; in June, Turkey, Spain, southern France, California, Tennessee, Virginia, Kentucky, Kansas, Utah, and Missouri; in July, Roumania, Austro-Hungary, southern Russia, Germany, Switzerland, France, southern England, Oregon, Nebraska, southern Minnesota, Wisconsin, Colorado, Washington, Iowa, Illinois, Indiana, Michigan, Ohio, New York, New England, eastern Canada; in August, Holland, Belgium, Great Britain, Denmark, Poland, western Canada, the Dakotas; in September and October, Scotland, Sweden, Norway, North Russia; in November, Peru and South Africa; in December, Burmah and Argentina. Thus the year around seed-time and harvest succeed each other, and somewhere wheat is always coming into market. Wheaten bread is the universal food of civilization, and whatever happens in the race for ascendancy in the world's markets, this seems assured: the Anglo-Saxon possesses the key to the world's wheat supplies at present, and is apt to hold it against all comers, at least during the twentieth century.

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THE END

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